

NAVAL POSTGRADUATE SCHOOL

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THESIS

INNOVATING THE STANDARD PROCUREMENT SYSTEM THROUGH ELECTRONIC COMMERCE TECHNOLOGIES

by

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December 1999

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The Standard Procurement System (SPS) is the next generation of procurement application software designed to link acquisition reform and common DoD procurement business processes with commercial best practices and advances in electronic commerce. When fully implemented, it will serve more than 1,100 sites worldwide and be employed by over 44,000 professionals. This research examines the SPS and emerging electronic commerce technologies that are revolutionizing the business industry today. Through a literature review and interview process, an analysis of the SPS along with Ariba Inc., a commercial paperless contracting venture, and leading intelligent agent software applications in e-commerce is presented. Innovation analysis is applied to the data gathered from the research to develop a new process design. As analysts predict that by 2003, business to business e-commerce will grow to \$1.3 trillion and 95% of business industry is going to go to paperless procurement, only an aggressive implementation of innovative technologies today will prepare SPS for the procurement needs of tomorrow. It is to this end that this research is conducted, with the intent of fostering innovative change in the SPS.

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Stephen P. Mangum
Captain, United States Marine Corps
B.S., University of Utah, 1991

Submitted in partial fulfillment of the
requirements for the degree of

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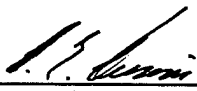
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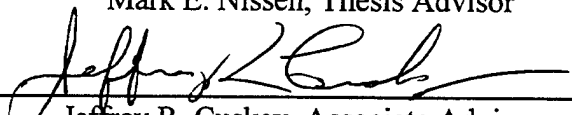
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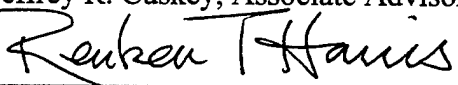
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I. INTRODUCTION

A. BACKGROUND

The acquisition reform initiatives of the Federal Acquisition Streamlining Act (FASA) of 1994 and the Federal Acquisition Reform Act (FARA) of 1996 have made sweeping changes in DoD procurement and have led to innovative changes to deal with a decreasing defense budget. One such change was a move to paperless contracting. The Secretary of Defense ordered that the paperless contracting initiative be implemented by January 1st of the year 2000. In addressing this requirement, the Defense Department in 1997 awarded American Management Systems Inc. a contract to develop the Standard Procurements System (SPS) software program via a Commercial-Off-The-Shelf (COTS) application. At the time, SPS was a \$241 million automated procurement system for use by the DoD procurement community [Ref. 1]. It is the next generation of procurement application software designed to link acquisition reform and common DoD procurement business processes with commercial best practices and advances in electronic commerce [Ref. 2].

Although the SPS program is only now being implemented in DoD contracting offices, and is in a state of infancy as

far its future potential is concerned, the program is already in danger of being cancelled. At the time of this writing, the SPS program has been removed from the FY 2000 defense appropriations bill after the DoD Inspector General (IG) reported the system could not function well [Ref. 1]. The system, which was expected to save \$1.8 billion over the next 10 years, has been canceled until the contractor can assure the DoD that the system can meet DoD's requirements.

Whether this specific SPS application continues to be used in the DoD or not, some type of SPS-like automated workflow software is likely to persist, as SPS represents the first step toward efficient and effective paperless contracting. Nonetheless, SPS, like its commercial workflow counterparts, has much room for improvement and innovation. Emerging e-commerce solutions found in successful commercial paperless applications and intelligent agent (IA) software technologies offer great potential to innovate SPS-like systems. These technologies have been driving the latest advances in the e-commerce revolution that is changing the business environment, as we know it. Through implementing these technologies into the commercial sector, agencies have realized significantly

increased efficiency and productivity in the performance of their businesses. As IA technology in e-commerce has yet to mature to the point of total automation of the procurement process, people and agents are most likely to share procurement responsibilities for many years, and we must learn to allocate acquisition process tasks between humans and software agents.

B. PURPOSE

This research analyzes the Standard Procurement System (SPS) and the corresponding standard procurement process to determine what capabilities in emerging e-commerce technology solutions are best suited for innovating the SPS of the future.

The objective is to recommend innovative concepts to be implemented in future versions of the SPS or its successor that offer dramatic performance improvements for the procurement process.

The intent of this work is not to detract from the tremendous effort that has brought this world class program to fruition, rather, it is to augment this effort by adding support to existing ideas and to recommend additional areas for innovative change in the system.

C. RESEARCH QUESTIONS

1. Primary Research Question

What areas of the Standard Procurement System can best be innovated with emerging e-commerce technologies?

2. Secondary Research Questions

1. What is the Standard Procurement System and what are DoD's paperless procurement requirements?
2. What are the advantages and disadvantages of the SPS?
3. Who is Ariba Inc. and why is their paperless contracting system so successful with Fortune 500 companies?
4. What are the advantages and disadvantages of Ariba?
5. What are intelligent agents and what effects are they having on the e-commerce industry?
6. What are the advantages and disadvantages of these agents?

D. METHODOLOGY

The methodology of this thesis uses a deductive approach utilizing Thomas Davenport's Process Innovation framework [Ref. 3] to analyze the SPS to determine what acquisition processes and tasks found in emerging e-commerce technologies, are most likely to bring about positive and innovative change to the SPS.

Data are collected via Government regulations, books, periodicals, theses, the Internet, interviews, and surveys.

The interviews are conducted with knowledgeable professionals in the fields of procurement, the SPS, commercial e-commerce companies and IA technology experts. The surveys provide user level input/feedback of the SPS. These methods are fused to develop an integrated perspective of how SPS can be innovated through IA technology.

E. SCOPE OF THESIS

The focus of this thesis is on innovating the SPS utilizing e-commerce technologies. The thesis focuses on the function of the SPS, from Request for Proposal to Contract Award of the Federal Acquisition Process (FAP). It uses data from SPS contractors, SPS users, Commercial paperless procurement professionals, IA experts and Commercial sector IA users to validate findings and conclusions. This thesis makes recommendations on how to innovate the SPS with e-commerce technologies in concept, but it does not attempt to provide insight into the infrastructure or programming required to create or support such a system.

F. ORGANIZATION

Chapter II follows this introduction and provides background information for the chapters that follow. It

reviews the basic framework of the Federal acquisition process, describes intelligent agent technology and outlines Davenport's Process Innovation Framework.

In Chapter III, the concept of paperless contracting is examined. This examination begins with a description of the DoD's Standard Procurement System and follows with a look at a commercial paperless contracting application with similar intent called ARIBA. This chapter concludes with a discussion of related IA applications in electronic commerce.

Chapter IV then applies Davenport's Process Innovation Framework to the information provided in Chapter III. Knowledge gained from analyzing the Government and commercial applications is then discussed along with opportunities identified for intelligent agent applications.

In Chapter V, recommendations for SPS improvements are made along with a migration strategy for their implementation.

Research questions are answered and key conclusions are summarized. The thesis concludes with recommendations for further research along these lines.

G. BENEFITS OF RESEARCH

The audience of this study includes DoD policy makers, SPS and SPS-like workflow systems architects and both current and future SPS users. This thesis provides a valid alternative to "paving the cow paths" of a system that some say merely automated the manual process, [Ref. 4] by offering an innovative alternative to the way contracts are processed using the SPS. The result may reduce cycle time, assist contracting professionals, improve the acquisition process, save money and aid in strengthening the SPS program.

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II. BACKGROUND

A. INTRODUCTION

This background chapter provides an overview of the DoD procurement process and includes some of the latest updates to the process. A basic understanding of intelligent agent software technology is also presented. IAs are fast becoming one of the greatest advances in electronic commerce today. The final section in this chapter outlines Davenport's process innovation framework model, which is applied to the information presented in Chapter III and analysis presented in Chapter IV.

B. FEDERAL ACQUISITION PROCESS

In his book, Federal Acquisition and Contract Management, Emmett E. Hearn describes the Federal procurement process as follows:

The United States of America is unique among nations in many ways. Not the least of its uniqueness is the method or process by which the Federal Government obtains the supplies and services necessary for it to function. The method is generally referred to as the Acquisition Process or sometimes as the Procurement Process. It is by this process that the Government enters in to contracts with the private sector of our country, as well as those in foreign countries, so that they may acquire those supplies and services that are needed to support Government programs, on time and at reasonable prices. [Ref. 5:p. 3]

The legal authority for the procurement process described by Hearn is founded in the U.S. Constitution and is regulated by the U.S. Congress. Due to changes in the Government, strategic policy and in technological advances over time, Federal Government contracting has been shaped and fashioned through a series of statutes, regulations, case law and administrative board decisions [Ref. 5:p. i], which has resulted in the procurement process used in the DoD today.

This procurement process is made up of three major phases as indicated below in Figure 2.1:

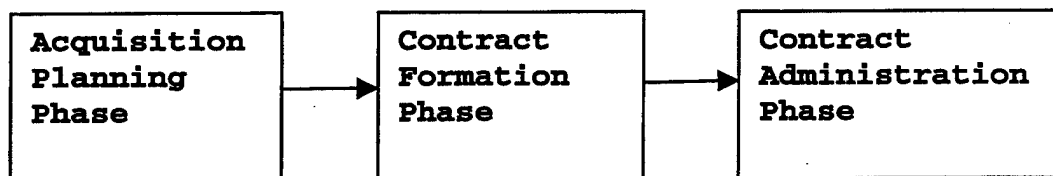


Figure 2.1 Phases of the Acquisition Process

A brief description of each phase of the acquisition process, along with the functions performed in each phase, is presented below. It is important to understand that this is a generic list of functions and that not every function will apply to every contract. The contracting specialist, according to the contract type and the circumstances of the contract, makes the decision as to

what specific functions apply. Each function has several sub-components called steps. There are a total of 85 steps in the procurement process. These steps are listed in Appendix (A). A detailed description of each of the 85 steps can be found in the Contract Specialist Workbook published by the Federal Acquisition Institute. [Ref. 7]

1. PHASE I: ACQUISITION PLANNING PHASE

The purpose of the acquisition planning phase is to decide whether or not to contract out the requirement and, if the decision is made to contract out, the groundwork is then laid for soliciting and awarding the contract. A principal goal of this phase is to build the solicitation that will be used to obtain bids, proposals, or quotations from vendors. [Ref. 6:p. 5-3] Referring to Figure 2.2, the five functions of the acquisition planning phase are: a) determination of need, b) analysis of requirements, c) extent of competition, d) source selection plan, and e) business terms and conditions. A brief discussion of each function is presented in turn.

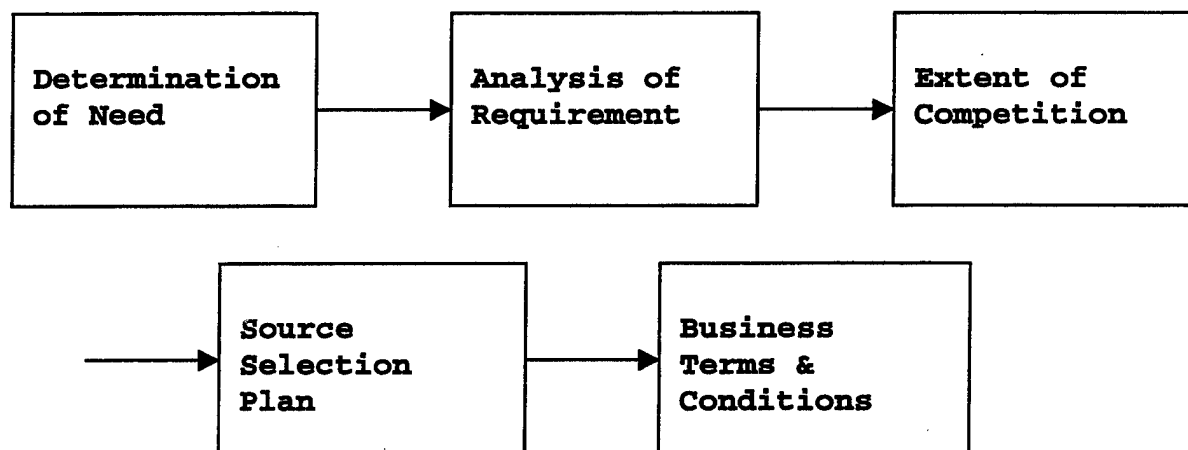


Figure 2.2 Functions of Acquisition Planning

a. Determination of Need

Before the procurement process can begin, a need for supplies or services must be established. Once established, a decision is made on whether to fulfill the need in house or to fulfill the need by contracting. If the decision is to contract, then the procurement process begins. To begin the process, an acquisition plan is developed, a purchase request for the supplies or services is submitted to the contracting officer and funding is sought. Market research is also conducted here to insure competition is maximized and that the need is met in the most prudent, effective, economical and timely manner.

b. Analysis of Requirement

In the second function, the requirements document is reviewed to ensure accurate and applicable

specifications are implemented and that an understanding of what is expected in the procurement is clearly conveyed. This may include such things as how Government furnished property or equipment will be used.

c. Extent of Competition

Here the issue of competition is resolved. The Competition in Contracting Act (CICA) of 1984 requires COs to promote and provide for full and open competition in soliciting offers and awarding contracts. This allows all responsible sources to compete. Occasionally there are exceptions to this Act. Sole source, unusual and compelling urgency and programs for small or disadvantaged businesses are a few examples of exceptions to CICA.

d. Source Selection Planning

When competition is anticipated, the CO must have a basis for selecting the best offer. Additionally, the CO must decide to lease or purchase the requirement, and evaluate price and non-price related factors. The CO must also decide whether to use Simplified Acquisition Procedures (SAP), sealed bidding or negotiation procedures for the procurement.

e. Business Terms and Conditions

Based on the information gathered at this point in the process, the decision is made on the type of contract to use for the procurement. Special conditions of the contract are also decided (e.g., incentives, contract financing and bonds). The final step in this function is to complete the procurement plan. This plan will be updated as the process matures.

2. PHASE II: CONTRACT FORMATION PHASE

The purpose of the contract formation phase is to solicit offers or quotations, evaluate offers or quotations, and award the contract. [Ref. 6:p. 5-4]

Referring to Figure 2.3, the four functions of the contract formation phase are: a) solicitation of offers, b) bid evaluation, c) proposal evaluation, and d) contract award. Again, a brief discussion of each function in this phase is presented.

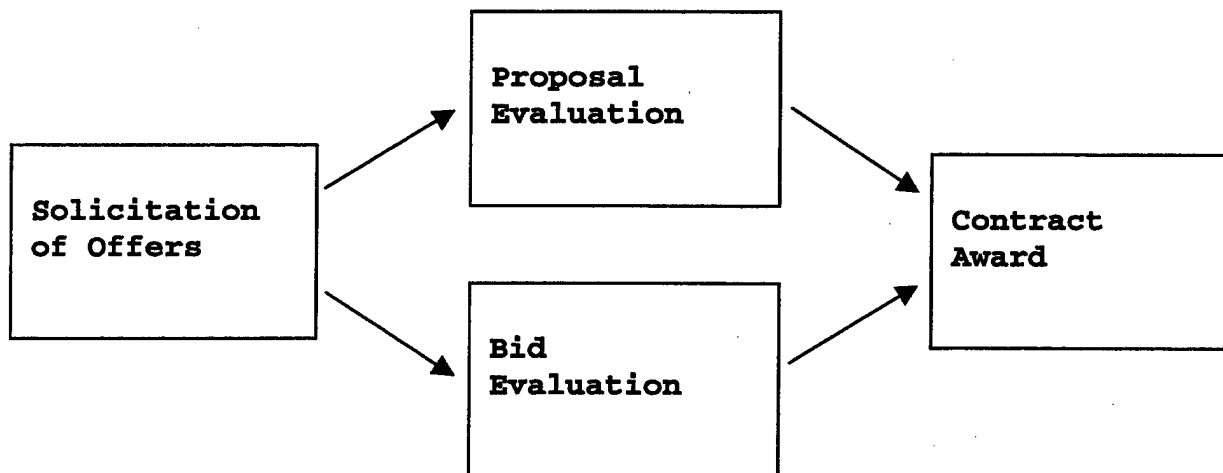


Figure 2.3 Functions of Contract Formation

a. Solicitation of Offers

Here the CO advertises the requirement by publicizing the proposed contract actions. Additionally, oral solicitations, pre-award inquires, and pre-bid/pre-quote/pre-proposal conferences may be held. The idea is inform as many authorized vendors as possible of the opportunity and then take additional measures to ensure they understand the requirement.

b. Bid Evaluation

In sealed-bid procurements, the contracting officer receives bids from potential contractors. The bids are evaluated to determine the best bid. The best bid is the one with the lowest cost that has come from a responsive and responsible offeror. A full price analysis

is generally performed to determine the bid with the lowest cost.

c. Proposal Evaluation

In negotiated procurements, the contracting officer receives proposals instead of bids from potential contractors. The proposals are evaluated to determine which proposal represents the best value to the Government. In addition to cost, the determination of best value can also be based on factors such as past performance, technical ability. The best proposals are considered to be in the competitive range. As necessary, discussions/negotiations are conducted with the offerors who made these proposals.

d. Contract Award

The primary mission of the final function of the contract formation phase is to award the contract to the successful offeror. Unsuccessful offerors are then debriefed as required. Another function of the CO is to attempt to resolve any mistakes or protests that may arise.

3. PHASE III: CONTRACT ADMINISTRATION PHASE

In this phase, the administration of the awarded contract is conducted. A formal or informal contract administration plan is usually implemented that tracks

receipt and acceptance of the deliverable item or service. It also ensures that the terms of the contract are complied with and that payments to the contractor are made. In keeping with the scope of this thesis, (Pre-award) more detailed discussion of the functions in the contract administration phase is not presented.

C. INTELLIGENT AGENT SOFTWARE TECHNOLOGY

1. Introduction

In the past 35 years, computer technology has gone from the sacred chambers of colleges and universities to common place tools found in most homes, offices and schools across the country. Computer technology has become a part of our everyday lives, making our car engines more efficient (e.g., control spark, fuel flow, emissions), entertainment more enjoyable (e.g., CD players/video games) and our communications easier and more efficient (e.g., telephone service, answering machines, email). This technology has opened up a whole new world of opportunities that is, for many, beyond comprehension.

Although many people using this technology may not fully understand how computers function, they do understand this technology has the ability to make our lives easier. Computers have become valuable tools that we work with to

increase our efficiency. We exploit their capabilities to reduce time and labor intensive tasks in the work place. For example, automated machines in factories significantly reduce the number of laborers required to build a car, and search engines on the Internet save countless hours of research time and effort.

Computers continue to evolve into jobs that could previously only be performed by humans and they are performing these tasks with greater precision and efficiency than ever before. Relatively new computer software technology has gone so far as to implement a form of artificial intelligence called intelligent agent software that enables computers to make semi-autonomous decisions on behalf of the person it represents. According to one definition, an intelligent agent is:

Software that assists people and acts on their behalf. Intelligent agents work by allowing people to delegate work that they could have done, to the agent software. Agents can, just as assistants can, automate repetitive tasks, remember things you forgot, intelligently summarize complex data, learn from you, and even make recommendations to you. [Ref. 8]

Despite its relative novelty, this emerging technology is already in place in many areas. From search engines that find you the best product prices on the Internet to "clippit", the paper clip assistant that shows up when help

is asked for in Microsoft Office '97, intelligent agents are fast becoming primary enablers to innovative changes in the computer industry.

The following is a brief discussion of three additional areas in which IAs are working with their human counterparts to make their life easier: 1) update agents, 2) stock agents, and 3) e-commerce agents.

2. Update Agents

These agents work 24 hours a day and seven days a week including holidays. They are always alert and looking for user specified information. This information could range anywhere from price fluctuations to published articles on a particular subject. As the agents detect the specified information, they immediately forward it to the user's email address. This type of agent saves countless man-hours that can now be allocated to other tasks. [Ref. 8: Update Bots]

3. Stock Agents

Stock agents come in many varieties, but all basically have the same intent: provide pertinent information to the user. Stock agents are similar to update agents in that they scour the web to find the latest available information. Stock agents, however, find

specific information on publicly traded companies. Stock agents then go a step further by processing the information received on these companies and make recommendations to the user on whether to buy or sell these stocks. They can also be tailored to focus on specific sectors of the market and even monitor the user's portfolio to make recommendations based on past preferences, market trends and available funds. This information can be presented to the user daily or continuously, depending on user preference. [Ref. 8: Stock Bots]

4. Electronic Commerce Agents

E-commerce agents have been in use for the last four years and are empowering the Internet buyer to get the best possible deal. Using these agents, buyers are able to sift through the growing plethora of businesses on the Internet and almost instantaneously find which business is offering the best price for their desired product. Additionally, some agents go beyond looking at just price and suggest which business offers the best overall value on the product. [Ref. 8: Commerce Bots] A more in-depth look at e-commerce agents is presented in Chapter III.

5. Agent Summary

With the flood of information provided by the Internet and the technological advances occurring in the computer industry at an ever-increasing rate, implementation of IA technologies will continue to become more important in our lives. As we find ourselves in positions where time and activities overtake us, we often seek help in the form of assistants. In the computer world, intelligent agents are playing the role of such assistants. [Ref. 8]

D. PROCESS INNOVATION FRAMEWORK

Given that this thesis is a study of an Information Technology (IT) application, which was created to fill the requirement of the paperless contracting initiative, Davenport's process innovation framework is used because of its suitability to analyze IT systems and processes. Davenport's process innovation framework, combines the adoption of a process view of the business with the application of innovation processes, and it offers enormous potential for helping organizations achieve major improvements in terms of process cost, time, quality, flexibility, service levels, or other business objectives. [Ref. 3]

Davenport's high-level framework to guide process innovation is presented below in figure 2.4. From this figure, one can see the framework is composed of five phases: 1) identifying process for innovation, 2) Identifying change levers, 3) developing process vision, 4) understanding existing process, and 5) designing and prototyping the new process. Each phase is discussed briefly in turn.

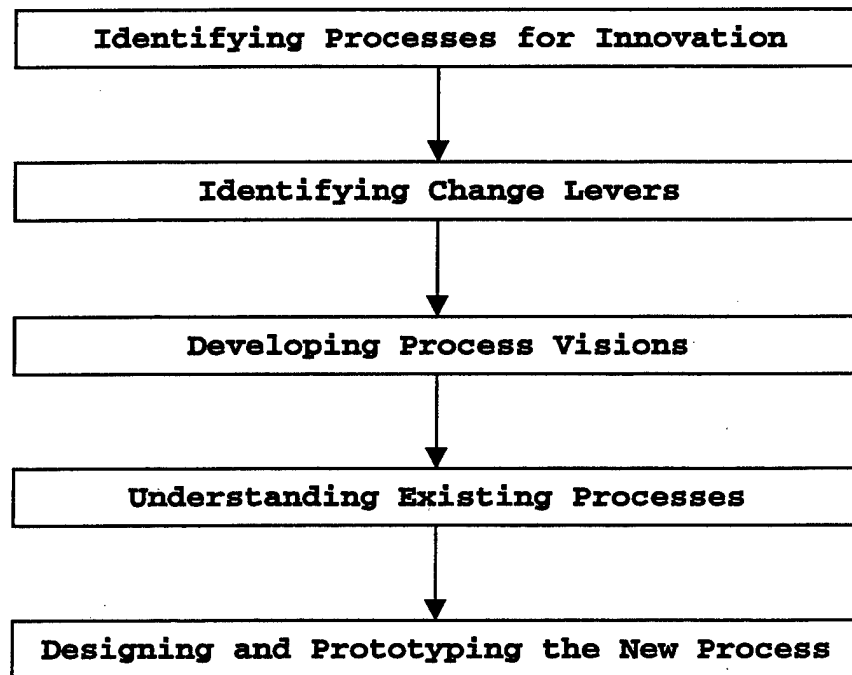


Figure 2.4 High-Level Approach to Process Innovation [Ref. 3:p. 25]

PHASE I: IDENTIFY PROCESS FOR INNOVATION

Phase I surveys the landscape of the organization to identify processes that are candidates for innovation.

[Ref. 3:p. 27] The candidates go through a selection process to determine which ones have the greatest need for radical change. Identifying and selecting processes for innovation is an important prerequisite to process change.

[Ref. 3:p. 35] Davenport's key activities in identifying processes for innovation are:

- Step 1: Enumerate major processes
- Step 2: Determine process boundaries
- Step 3: Assess strategic relevance of each process
- Step 4: Render high-level judgments of the "health" of each process
- Step 5: Qualify the culture and politics of each process

PHASE II: IDENTIFY CHANGE LEVERS

In phase II the tools to facilitate the innovative change or change levers are identified. The change lever(s)/enabler(s) selected become the vehicle(s) of the change process. The key activities for identifying change enablers are:

- Step 1: Identify potential technological and human opportunities for process change

- Step 2: Identify potentially constraining technological and human factors
- Step 3: Research opportunities in terms of application to specific processes
- Step 4: Determine which constraints will be accepted

PHASE III: DEVELOP PROCESS VISIONS

After enablers have been identified as relevant and explored in a preliminary fashion, an organization can begin to construct a vision for the new process. [Ref. 3:p. 113] In phase III, the vision for the future process is developed based on the organization's strategy and process objectives. The key activities in developing process visions are:

- Step 1: Assess existing business strategy for process directions
- Step 2: Consult with process customers for performance objectives
- Step 3: Benchmark for process performance targets and examples of innovation
- Step 4: Formulate process performance objectives
- Step 5: Develop specific process attributes

PHASE IV: UNDERSTANDING EXISTING PROCESSES

In phase IV the organization's existing process is analyzed and documented in order to develop a common understanding of the existing processes. This provides a base from which to start that also serves as a reference

point to measure future benefit. The key activities in understanding and improving existing processes are:

- Step 1: Describe the Current Process Flow
- Step 2: Measure the Process in Terms of the New Process Objectives
- Step 3: Assess the Process in Terms of New Process Attributes
- Step 4: Identify Problems with or Shortcomings of the Process
- Step 5: Identify short-term Improvements in the Process
- Step 6: Assess Current Information Technology and Organization

PHASE V: DESIGN AND PROTOTYPE THE NEW PROCESS

Phase V reviews information collected in earlier phases of the change initiative and synthesizes it to develop the new process. [Ref. 3:p. 153] The key activities in designing and prototyping a new process are:

- Step 1: Brainstorm Design Alternatives
- Step 2: Assess Feasibility, Risk, and Benefit of Design Alternatives and Select the Preferred Process Design
- Step 3: Prototype the New Process Design
- Step 4: Develop a Migration Strategy
- Step 5: Implement New Organizational Structures and Systems

Refs. 3 and 9]

E. SUMMARY

As is evident from the outline of the federal procurement process noted above, it is a long and labor intensive process. It is no wonder that there has been so much focus on streamlining and innovating this process. The challenge however, is to innovate the process without degrading its effectiveness.

One high potential candidate to aid the Government procurement process is IA software applications that have the ability to assist their users (e.g. performing redundant and time consuming processes) and allow users to become more efficient and effective in the work place. Although a select few uses of IA applications are outlined in this chapter, the list of potential uses is extensive and growing. As a vehicle for innovative change in the procurement process, such technology is particularly attractive.

III. PAPERLESS CONTRACTING

A. INTRODUCTION

Increased competition, new technologies, and rapidly changing global markets are forcing businesses to identify strategies for attaining continuous improvements in productivity and cost management. Such pressures have encouraged many companies to reexamine how they manage, control, and acquire the operating resources that are required to maintain daily business activities. [Ref. 10:p. 2]

Today, the pursuit of aggressive streamlining strategies and cost-effective management techniques are as common in the Government as the commercial sector. As both sectors look to technological advances for streamlining solutions, advances in procurement management technologies like paperless contracting are proving to be a key procurement management tool for significant savings in both time and money. At the rapid rate that paperless contracting is being assimilated into the business sector, analysts project that by the year 2003, 95% of business industry is going to go to paperless procurement. [Ref. 11]

This chapter looks at the DoD's paperless contracting initiative, SPS, and the PD2 program that has been selected to meet the SPS requirement. An overview of Ariba Inc., a commercial company that provides a similar paperless procurement service in the commercial sector, is also

presented here as an example of a commercial application to an SPS similar need. The chapter concludes with an overview of e-commerce IA technology applications that may hold potential now or at some point in the future to further innovate the procurement process. Each section begins with a history, followed by the program's or technology's current status, its future visions, and then concludes with perceived advantages and disadvantages.

B. THE STANDARD PROCURMENT SYSTEM

1. History

Prior to the development of SPS, miles of contracting documents were created and stored every year in giant warehouses. This cost the Government millions of dollars annually to catalog and store. Additionally, the different services and buying organizations in the DoD were independently spending millions of dollars to develop automated procurement programs that were tailored to the needs of the individual agencies. These programs are now referred to as legacy systems. In an effort to reduce the cost of paper based contracting, streamline the automated procurement effort by having one universal system, and take advantage of the latest it advances in procurement, the

Secretary of Defense mandated that the DoD move to a paperless procurement system by January 1, 2000.

With an understanding that the DoD is the largest buying organization in the world, the development of a standard system for the procurement of goods and services to be used by all DoD agencies appears to be a difficult task. The development of such a system was expected to revolutionize the defense procurement world and fulfill the DoD's vision of paperless acquisition.

In 1995 the Department of Defense announced the acquisition of the Standard Procurement System, a plan designed to standardize all procurement functions into one package. The goal of SPS was to select a commercial-off-the-shelf (COTS) software solution to replace the 12 legacy systems in use worldwide. This single solution had to fulfill the diverse procurement and contracting activities of the DOD, from purchasing office supplies, uniforms, and sundry items to weapons systems, helicopters, and tanks. [Ref. 12:p. 1]

Later, in April of 1997, the DOD awarded the 10-year, \$240 million SPS contract to American Management Systems (AMS). [Ref. 12:p. 5] AMS's SPS program is called Procurement Desktop Defense or PD2 for short.

Although PD2 was determined to be the best COTS software package, it is important to note that the PD2 program was selected to be the SPS program foundation, not the final product. In fact, one could say that PD2 was and

is a developmental work in progress that is continually evolving, while in use, in order to meet the current and future needs of the largest and most complicated buying organization in the world.

With such an unprecedented undertaking, an incremental deployment strategy was developed to gradually replace the 12 legacy systems in order to minimize user impact and to incorporate the latest technological capabilities as they emerge. To date, there have been six major upgrades to PD2, with the latest version being 4.1b. By the first quarter of 2003, PD2 is slated to have gone through seven additional upgrades, and it is to be fully functional upon fielding of version 5.1 at that time. PD2 version 5.0 and 5.1 will be discussed later on in this section.

When fully implemented, PD2 will serve more than 1,100 sites worldwide and be employed by approximately 44,000 users. The intent of the design is to standardize business processes across the DOD, automate the procurement process and eliminate redundant procedures in the process, improve communications across the board and increase functionality [Ref. 12] to enable a streamlined and more efficient government procurement process.

As can be expected whenever a significant change in a system occurs, problems and challenges emerged. Early versions of PD2 were plagued with bug related problems that caused systems to crash, required numerous "workarounds" and excessive time delays. In January 1999, Elliot Branch, the Navy's executive director of acquisition and business management, stopped installation of SPS at Navy installations worldwide because of what he termed "show-stopper" software glitches. In July of this year, Congress called on the Defense Department to suspend deployment of any additional hardware, software and networking equipment needed to run the system because of concerns raised by a GAO report of PD2's inability to meet the requirements of the users. [Ref. 13]

Additionally, Daniel Verton, a reporter for Federal Computer Weekly, claims that "Users are lashing out at what they believe are significant shortfalls in capability of the program." [Ref. 14:p. 2] One of the complaints is that PD2 is a very complex system that is not user friendly and takes a tremendous amount of training in order to employ. To address the training requirement issue, AMS conducts more than 30 PD2 classes a month and trained some 7,500 users in 1998. [Ref. 12:p. 9] Unfortunately, this effort

has brought forth accusations that claim AMS is charging inordinate amounts of money for configuration and training services once the system is installed. [Ref. 14:p. 2]

Reportedly, the Army spent as much as \$11 million last year for post-installation and training support, and a single Navy command spent \$6 million. [Ref. 14:p. 2]

There have been success stories with the program as well. The first DOD agency to complete the conversion to the SPS is the Army Space and Missile Defense Command in Huntsville, Alabama. They reported improved business processes that resulted in 25%-33% faster acquisition lead times. Additionally, as each update has been released, bugs have been worked out and confidence in the system has gradually increased. Although the issue with Congress is yet to be resolved, Mr. Branch has now stated, after extensive testing of version 4.1a, that the software is ready for deployment to Navy sites.

At the time of this writing, \$326 million has been spent on the program, and an additional \$100 million is being requested by the SPS program office to fix software problems and to sustain existing automated procurement systems. [Ref. 14]

2. Current Status

Currently, PD2 is deployed to more than 300 sites and is supporting more than 15,500 users worldwide. The PD2 versions currently being employed by users range from version 3.5 to 4.1b as indicated in Figure 3.1. The older versions are still being employed at some sites due to compatibility with equipment, technical infrastructure and legacy systems.

Total Installed Users By Version

As of 30 September 1999 Total Users

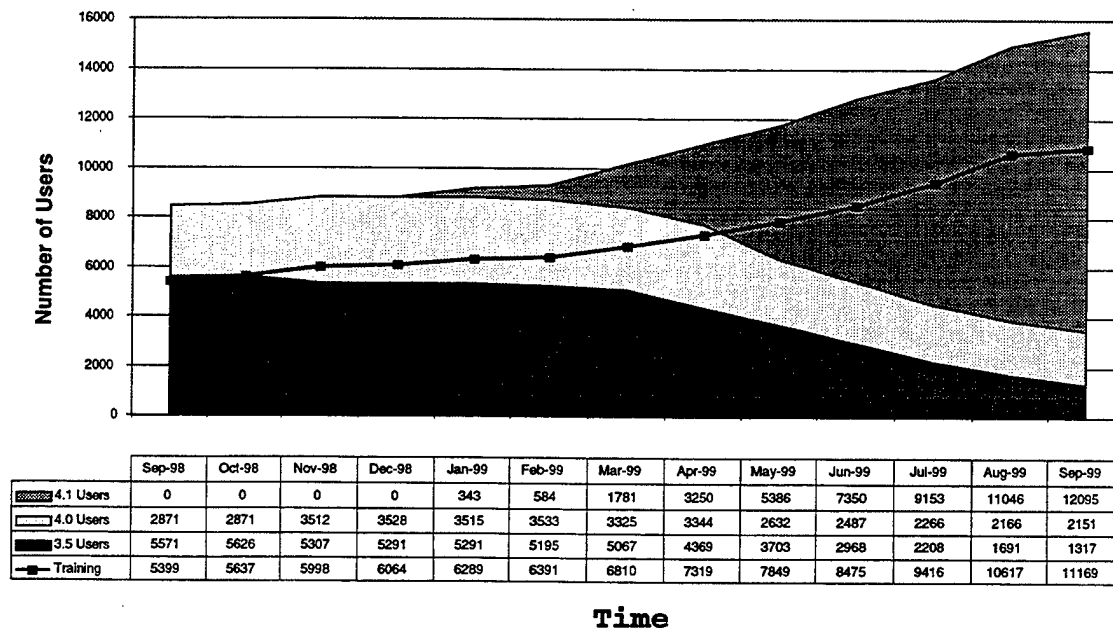


Figure 3.1. SPS USERS BY VERSION [Ref. 15:Slide #18]

As future upgrades are fielded, and when the current hold on new hardware procurements by Congress is lifted, the old versions of PD2 will be phased out along with the legacy systems.

An overview of the system is now presented starting with Figure 3.2, which is a sampling of the basic tasks the PD2 is designed to perform.

PD2 FUNCTIONS

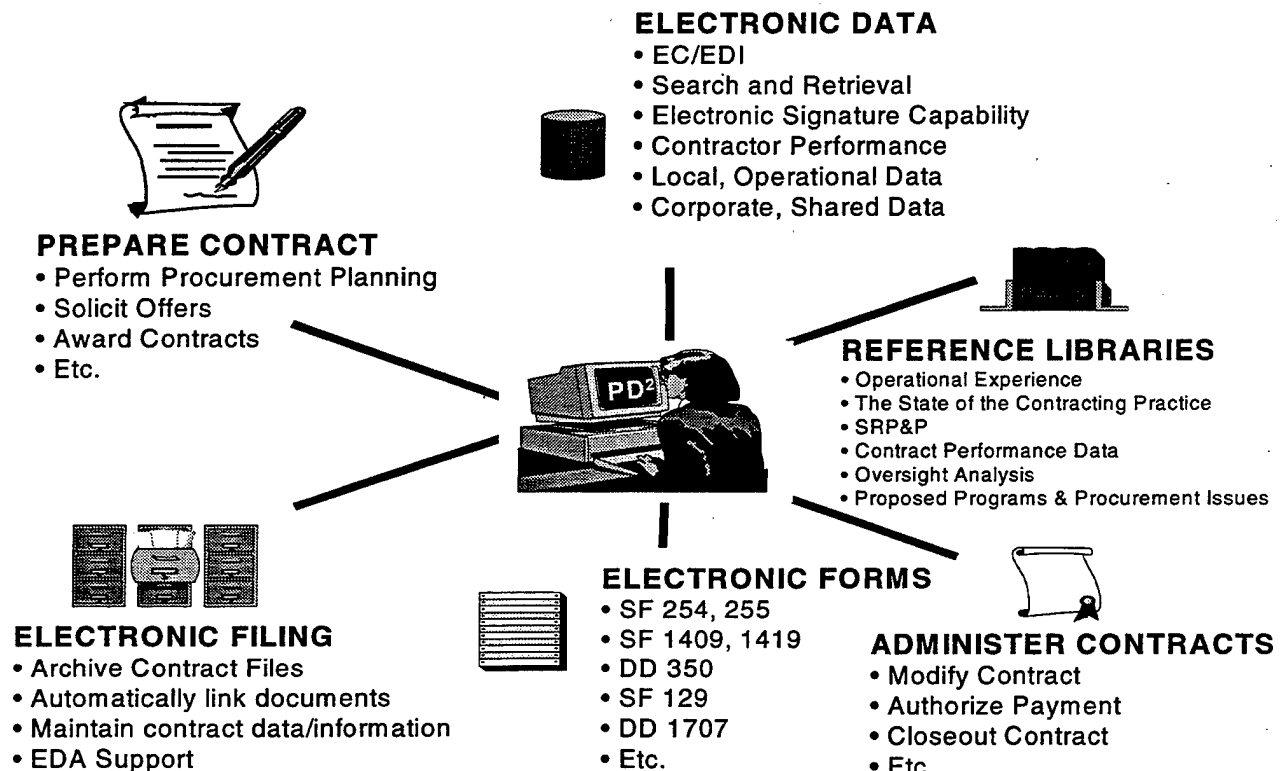


Figure 3.2. PD2 Functions [Ref. 15:Slide #5]

SPS users experience a Windows-based desktop system with menus to navigate through the procurement process. Functions include automated clause selection, report generation, summary of changes for contract modifications, and ability to electronically process all files associated with the contract. PD2 enables users to access databases and make use of Windows-based applications, such as Word and Excel. Users can share data and keep track of related procurement documents, all within the same database. [Ref. 12:p. 3]

Access to the database, and the rest of the PD2 system, is gained through a regional/hub server. Remote contracting office sites link to the server via the Internet. It is important to understand that PD2, however, is not a web-based program. It is currently a relatively flat system that primarily flows within the bounds of an Intranet as illustrated in Figure 3.3. Although functional, it severely limits the capability of the system to become truly paperless in the procurement process.

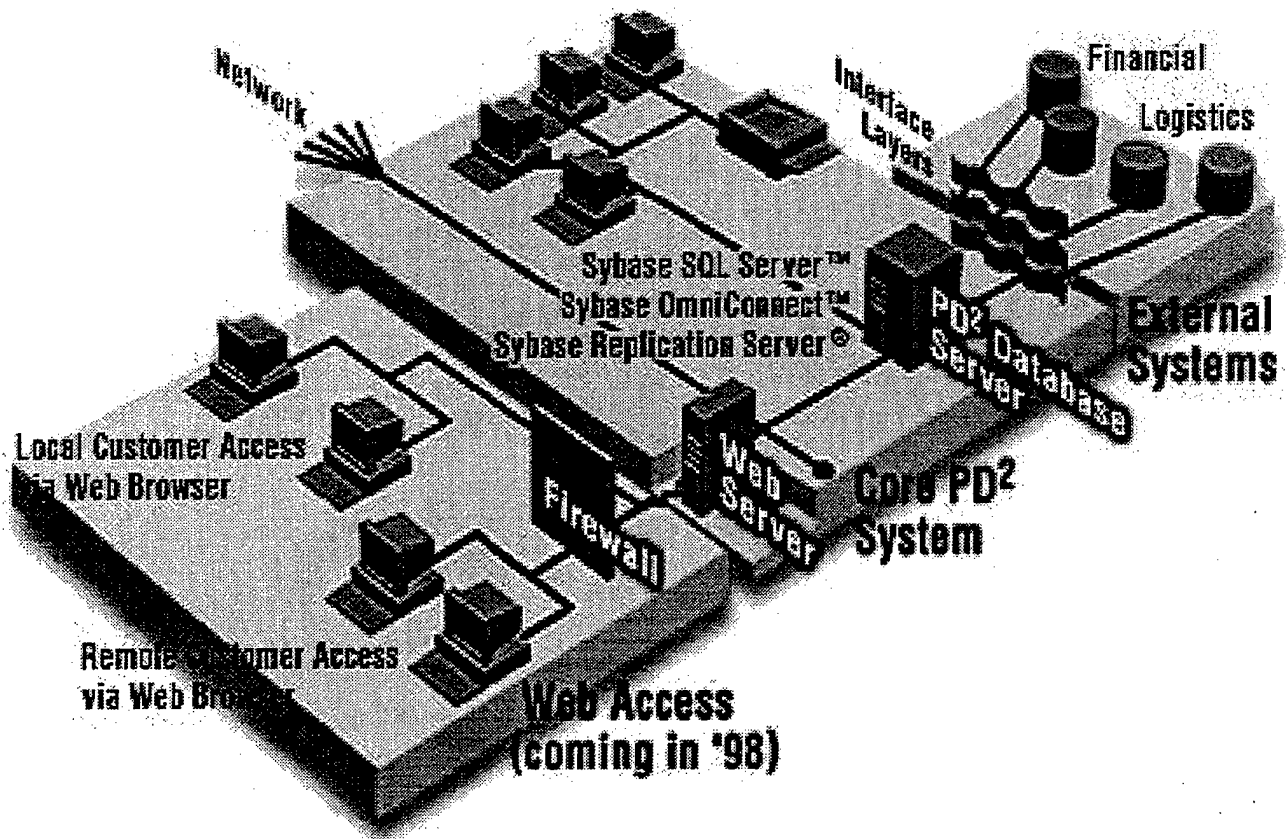


Figure 3.3 PD2 Process Flow Diagram [Ref. 16]

A web-based program is available to PD2 customers from AMS called Aquiline. Unfortunately, there is a significant cost involved in obtaining this feature that is not covered under the DoD contract. The benefits of a web-based procurement system are briefly covered in an article presented by AMS in a quarterly newsletter for Army SPS sites called ARTwork. It reads:

To become truly paperless, procurement offices must provide a paperless channel to their customers, vendors and legal and finance departments. AMS developed Aquiline, a Web-based modular suite, to enable customers to input

data and view status information via the Internet. This front-end software distributes the power of PD2 to all organizations involved in a DoD acquisition. [Ref. 17:p. 4]

Currently, the Army is the only service that is purchasing the service from AMS, although there are some Navy commands that are considering it.

In Chapter II, an overview of the Federal procurement process, from requirement generation to contract award, is presented. The current status of PD2 functions as they relate to the Federal procurement process is presented in the same scope in Table 3.1. LCDR David Fowler, a fellow student of the Naval Postgraduate School, who concurrently researched another aspect of the SPS for his thesis, [Ref. 18] created this table and its description. It has been modified for this application, but can be viewed in its original form in Appendix B.

The table graphically presents the existing standard procurement process by comparing the acquisition baseline to the functionality of SPS. The comparison indicates what functions SPS does and does not automate. This is marked in the second column (SPS Performs) by a (+) if SPS automates the function, a (0) if it only supports that function, or a (-) if it does not automate or support it. [Ref. 18] Column three indicates whether IA technology is

SPS Functions in the FAP

Phase I: Acquisition Planning			
FAP Function	SPS Performs	IA Assisted	Method
A. Determination of Need			
1. Forecasting Requirements	0		
2. Acquisition Planning	0		
3. Purchase Requests	+		
4. Funding	0		
5. Market Research	0		
B. Analysis of Requirement			
6. Requirements Documents	+		
7. Use of Government Property/Supply Sources	+		
8. Services	-		
C. Extent of Competition			
9. Sources	+		
10. Competition Requirements Unsolicited Proposals	0		
11. Set-Asides	+		
12. 8(a) Procurements	+		
D. Source Selection Planning			
13. Lease vs. Purchase	-		
14. Price Related Factors	-		
15. Non-Price Factors	-		
16. Method of Procurement or Purchasing	+	Yes	Auto Contract logic
E. Solicitation Terms & Conditions			
17. Contract Types— Pricing Arrangements	+	Yes	Auto Clause logic
18. Recurring Requirements	0		
19. Unpriced Contracts	-		
20. Contract Financing	0		
21. Need for Bonds	0		
22. Method of Payment	0		
23. Procurement Planning	+		

(+) = SPS automates and performs

(0) = SPS only supports

(-) = SPS does not automate or support

Table 3.1. SPS Functions in the FAP [Ref. 18]

SPS Functions in the FAP

Phase II - Contract Formation			
FAP Function	SPS Performs	IA Assisted	Method
F. Solicitation of Offers			
24. Publicizing Proposed Contract Actions	+		
25. Oral Solicitation	-		
26. Solicitation Preparation	+		
27. Pre-Award Inquiries	+		
28. Prebid/Prequote/ Preproposal Conferences	-		
29. Amending/ Canceling Solicitations	+		
G. Bid Evaluation			
30. Processing Bids	-		
31. Bid Acceptance Periods	-		
32. Late Offers	-		
33. Price Analysis —Sealed Bidding	-		
34. Responsiveness	-		
H. Proposal Evaluation			
35. Processing Proposals	+		
36. Applying Non-Price Factors	0		
37. Price Analysis-Negotiations	0		
38. Pricing Information From Offerors	+		
39. Audits	+		
40. Cost Analysis	-		
41. Evaluating Other Offered Terms/Conditions	0		
42. Award Without Discussions	+		
43. Communications/Fact-finding	+		
44. Extent of Discussions (Competitive Range)	0		
45. Negotiation Strategy	0		
46. Conducting Discussions/Negotiations	-		

Table 3.1. SPS Functions in the FAP [Ref. 18] (Continued)

currently incorporated into this function. Only yes answers are displayed along with the method of application.

As a reminder, it is important to understand that there are many more functions to the SPS, which are not covered in the scope of this table and research. To gain full knowledge of the SPS and all the features of PD2 goes beyond the scope of this thesis and is better left to the users guide and training CD that are available with the purchase of the system.

3. Future Vision

In the near future SPS is looking to field version 4.1C and retire two additional legacy systems. Version 4.1 is tabled to continue onto 4.1f, with quarterly maintenance releases, before being replaced by version 4.2.

As depicted in the Deployment Roadmap in Figure 3.4, version 4.2 is scheduled to be released in the first quarter of the year 2001. 4.2 will be focused toward retiring legacy systems within the Post, Camp and Station Community, expanding contract administration capabilities and achieving full operating capability within those communities. [Ref. 19] The subsequent release of version 5.0 in the 2nd quarter of 2002 will be targeted

Deployment Roadmap

Projected Remaining Legacy Retirements

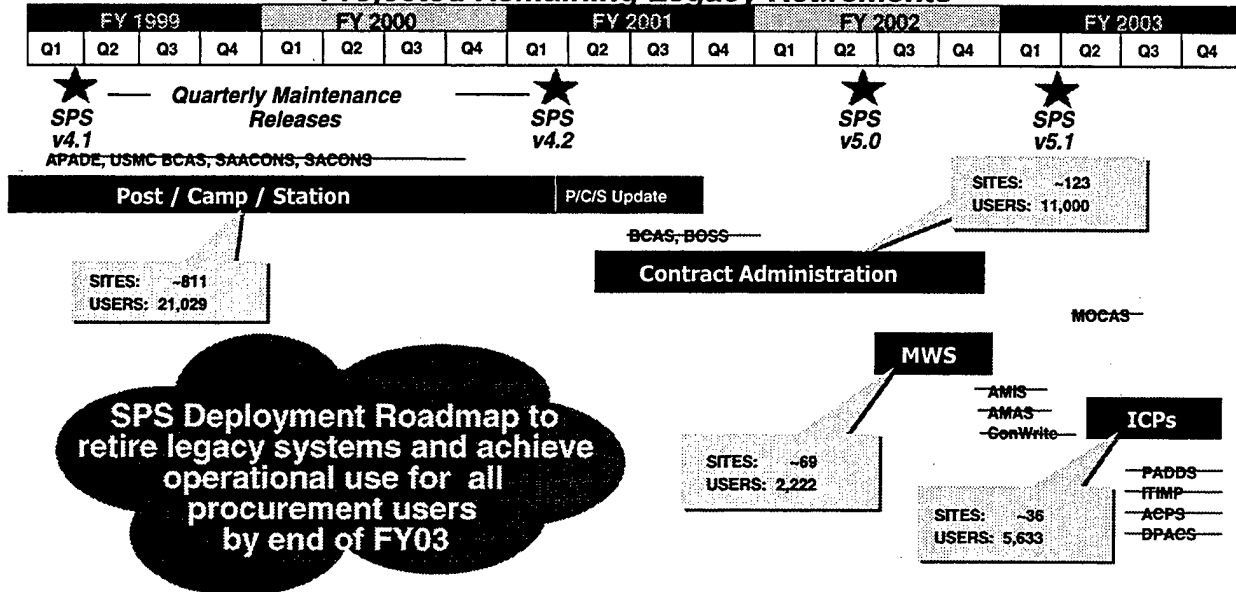


Figure 3.4. Deployment Road Map [Ref. 15:Slide #14]

toward Major Weapon System's communities throughout the Department. Version 5.1 is slated to be implemented in 2003 and will be targeting the inventory control point community. Additional functions of 4.2, 5.0 and 5.1 can be found in Appendix C.

The future vision of SPS is best described in the closing remarks of Major General Malishenko, Commander of the Defense Contact Management Command, in a recent article that he wrote on SPS:

Though the next four years of SPS implementation will be challenging, both DoD and its contractor are committed to addressing these issues in a timely manner through education, two-way communication, and training. The result will be best business practices that will effectively prepare and guide the DOD into the next century. [Ref. 12]

4. System Advantages

As improvements to the SPS are being made on a continual basis, as indicated in Figure 3.4, only higher level advantages are listed that should not be quickly outdated.

a. Automated System

Automating the procurement process is the first major step in innovating the process. The initial fielding of this program has provided a base that has and will allow for organizational and technological advances to be implemented as they emerge.

b. Deployment Plan

The gradual implementation of SPS and PD2 functionality provides a realistic approach to meet the paperless contracting requirement in a realistic time for the largest buying organization in the world. This should also allow some flexibility in the system for implementation of emerging technologies.

c. Broad Range of Functionality

The SPS is required to meet the needs of more customers, and to incorporate more regulations into every purchase, than any other program in the world. SPS's ability to address these requirements is remarkable. Of particular note are the Auto Contract logic tool, which suggests the type of contract, and the Auto Clause logic tool, which automatically suggests applicable references for the type of contract being created as noted in Table 3.1. Both tools are IA type applications.

5. System Disadvantages

Like advantages, only higher level disadvantages, as perceived by the author, are listed here.

a. Y2K Deployment Requirement

The Secretary of Defense requirement for a DoD wide paperless contracting program to be implemented by the year 2000 appears to have been an unrealistic goal. A rush to meet this goal may have led to fielding software that was less than optimal, with a plan for future improvements to be made. This resulted in frustration and a loss of confidence in the system by the users. This in turn led to speculation by congress that PD2 was not meeting the needs

of the Government. This weakened the credibility of the program.

b. User Interface

The PD2 system is reportedly not user friendly. It requires extensive initial and follow on user training. In some cases, services have purchased millions in additional training from AMS in an attempt to improve user efficiency with the program. The cost in man-hours lost to extensive training must be considered as well.

c. Not Web-Based

By using a regional hub server system, capability of the SPS is significantly limited. It prevents the smooth transfer of documentation from procurement offices to customers, vendors, legal offices and finance departments in a truly paperless format. This is a disadvantage because it requires workarounds like cut and paste emails and off line fixes of errors and changes to documentation.

Additionally, it restricts contracting personnel from fully utilizing the resources and capabilities offered through a web-based system, that could significantly increase their efficiency.

d. Limited Use of Intelligent Agent Technology

The current limited use of IA applications in the SPS are a disadvantage to the system, as SPS users are unable to benefit from this technology that is revolutionizing the e-commerce industry. The capability of this type of software will be discussed later in this chapter.

C. Ariba Inc.

1. History

In September of 1996, a company called Ariba Inc. was founded. This company believed that if companies were able to manage their Operating Resources (OR) more efficiently, they could obtain these resources at a reduced price, often 10%-20% less. OR procurements are classified as non-production supplies that can range from pens and notepads to capital equipment and services. They believed that by automating the OR procurements with a web-based paperless contacting system, they could reduce middleman costs and time delays, decrease cycle times in obtaining these resources, and improve control of operating resource purchases while increasing end-user satisfaction.

Their theory, if a 10% savings could be realized from improved Operational Resources Management (ORM) in a

fortune 500 company that annually spends \$500 million in OR procurements, the result would be a \$50 million annual savings that directly increases company profit. With many Fortune 500 companies spending in excess of \$1 billion on OR, the feasibility of such a venture now seems intuitive.

Ariba began its venture targeting Fortune 500 companies like Chevron, Bristol-Myers Squib, Cisco Systems and General Motors, primarily because that is where the greatest savings could be realized. The problem initially was that Ariba was a new entrant into a market that had existing providers of a similar service. Ariba gradually gained the advantage over, and the accounts of, its competitors. This is due in part to superior product function, but primarily due to their superior user interface. The corporate giants were looking for a simple, browser-based interface that could be employed by any individual in the organization and not just the experts in the purchasing department. The primary competitor's product required extensive training and was so difficult to use that even those who were capable of using it preferred to work around it. [Ref. 20]

Ariba's "walk-up interface" and ORM philosophy proved to be just what the corporate giants were looking for.

With total sales of \$45.4 million in its latest fiscal year, Ariba is undoubtedly the frontrunner in the business to business e-commerce market. [Ref. 21:p. 3]

2. Current Status

The hallmark of a successful business network is its ability to integrate business buyers with their suppliers in the most efficient and effective way possible. [Ref. 22:p. 2]

Ariba software and services automate the internal and external commerce processes linking buyers, suppliers and value-added service providers through a global e-commerce infrastructure to provide cost savings and revenue opportunities for businesses of all sizes. [Ref. 23] The software delivers a unified product catalog listing the products of all a company's authorized suppliers with volume pricing. It generates purchase requisitions, automatically routes them to appropriate managers for approval, interfaces with company accounting systems to generate payments, and tracks which employees are authorized to buy what products. The system reduces paperwork, speeds transactions, prevents maverick buying, and allows a purchasing department to control where money gets spent. [Ref. 24] ("Maverick Buying" includes purchases made from non-preferred vendors.

A purchase made with Ariba software works like this:

You want to purchase a whiteboard for your sales talk. You launch your Internet browser and log into the procurement site on your company's Intranet. Click on "create" to get a requisition form. Now you navigate through your employer's custom electronic catalog of all the goods and services that you are authorized to purchase. The catalog is organized by product. You might have two to five choices, each with a price, lead time, size and manufacturer's name. Click on any choice, and you are linked to the manufacturer's Web site for a more detailed description and photograph of the item. You complete the form, filling in a space to explain why you want this item. The form is automatically routed to your boss for approval and an electronic signature, then to the wholesaler or manufacturer of this item. The cost finds its way into your accounting database. At any time you can check on the status of the order, just as you might use your computer to check on the status of a Federal Express delivery. [Ref. 25]

Your company saves money by getting a reduced price from a preferred supplier, eliminating the internal paper chase and its associated costs (\$80-\$150 per transaction) and the supplier has saved over his paper processing method costs as well.

With a work force of 456 employees, Ariba currently services over 12,000 customers making ORM purchases over the Internet. As demand for the capability that Ariba offers has grown, and more small and medium-sized businesses seek to reap the same 10%-20% savings that larger companies have achieved through ORM, upgrades to

Ariba's program have allowed it to offer more functionality to a broader range of users.

Two products have enabled this expansion: the Ariba Network™ and Ariba Internet Business Exchange™ (Ariba IBX™). Ariba Network connects the rapidly growing number of buying organizations using Ariba ORMS™ with their even more rapidly growing set of suppliers via the Internet. Ariba's IBX™ product enables Ariba partners to quickly build online markets for their customers. Buyers accessing an IBX marketplace gain the benefit of reduced-cost access to goods without the need to install a complete ORMS of their own. Suppliers gain access to a new market that delivers an efficient, electronic order stream that can be processed cheaply. [Ref. 26] This allows organizations to develop new revenue opportunities and to create deeper relationships with their small to mid-size business customers. It also extends the benefits of the Internet economy to new businesses of all sizes and technical capabilities. [Ref. 27]

3. Future Vision

Ariba is well positioned to take full advantage of the phenomenal growth expected in the business to business e-commerce, as Forrester Research projects that business to

business e-commerce will grow to a \$1.3 trillion market by 2003. [Ref. 21] In upcoming releases you can expect to see support for materials auctions, and reverse auctions.

Reverse auctions will be discussed in the next section of this chapter. A "Req-to-Check" feature is also planned that provides users a complete summation of a purchase from creating the requisition to making the payment. [Ref. 26]

The long-range vision of the company is to continue to provide a common infrastructure for Internet commerce to leverage the economies of scale that the Internet makes possible. [Ref. 26]

Although IA type features are evident in Ariba's help and contract tracking features, additional IA features have been discussed but not implemented as of yet. According to Andrew Gumperz of Ariba, intelligent agent functionality will be implemented as customers make IA type functions a priority. [Ref. 28]

4. System Advantages

a. Walk-Up User Interface

Ariba purposefully created a user-friendly interface that did not take extensive training and would not require additional training for occasional users. This feature not only enabled Ariba to surpass its competition

and become the number one company in its market, but it allowed organizations to empower end-users to make simple purchases using Ariba as well. This saved processing time, increased customer satisfaction and allowed contracting offices to focus on more important issues than paperclips and pens.

b. Preferred Buyers/Suppliers

Ariba allows buyers to link to OR vendors. Customers become preferred buyers, to which vendors offer significant discounts. The transactions are all handled over the Internet, so transaction costs on both sides are reduced. The resulting savings in the cost of products results in a direct increase in company profit.

c. Reduces Maverick Buying

Maverick buying, which often accounts for 30%-40% of the purchases a company makes, results in paying 15%-27% higher prices from non-preferred vendors. Ariba's program helps to prevent maverick buying by only allowing purchases through preferred vendor sources.

d. Web-Based Network System

This system ties all of the participants into a common network infrastructure and allows the transfer of information from buyer to manager to vendor to shipper to

the finance office, without recreating or printing the original document. This paperless process also allows for tracking of the purchase anywhere along its path. When waiting for an important or time sensitive purchase, this feature would be considered a tremendous asset.

5. System Disadvantages

a. Doesn't Deal With Regulations

Ariba does not have the functionality built into it to deal with regulations like the Federal Acquisition Regulation. Although it is not a disadvantage for the civilian sector, it would be if it were employed by Government agencies that are required to abide by a plethora of regulations.

b. Limited Source of Supply

Buyers agree to purchase their supplies from the limited number of suppliers, and the suppliers in turn provide discounted prices on OR. Again, this works well for civilians, but it may not work for Federal Government buyers who are regulated by the Competition in Contracting Act (CICA). CICA requires full and open competition when awarding contracts. Ariba's system purposefully limits competition to achieve volume discounts and may limit new entrants.

D. AGENTS IN ELECTRONIC COMMERCE

1. History

Electronic commerce encompasses a broad range of issues including security, trust, reputation, law, payment mechanisms, advertising, electronic product catalogs, intermediaries and back office management. Agent technologies can be applied to any of these areas where a personalized, continuously running semi-autonomous behavior is desirable. However, certain characteristics will determine to what extent agent technologies are appropriate. [Ref. 29:p. 5]

In 1996, as more and more businesses were posting their goods on the Internet for sale, the ability to sift through the information, to determine which vendor was offering the best price, was becoming more and more daunting. IA researchers saw the opportunity to assist buyers on the Internet in finding the best deals. One of the early applications of IA technology in e-commerce was BookWorms Bargainbot [Ref. 30]. It was a search agent that searched virtual bookstores like Amazon.com, CumpuBooks, and Books.com for the best prices on books. This innovative new e-commerce solution empowered buyers to obtain nearly instantaneous price comparisons as opposed to a time consuming process of independent human generated comparisons in real or virtual bookstores that would take hours to replicate. Although the searches sometimes came up with errors due to several bugs in the system, they

provided a feasible option to browsing the musty aisles of the local bookshop. As long as customers knew what they wanted, Bargainbot could help worm through the plethora of books available via the Web [Ref. 30] to find the best available price. The term "bot" used in Bargainbot's name is a nickname for intelligent agents that evolved from the sci-fi depiction of autonomous operating robots of the future is common in the IA community.

2. Current Status

Agent technology has evolved at a rapid rate since the introduction of Bargainbot. Today, new IA applications in e-commerce are emerging almost daily as businesses continue to realize the overwhelming ability of agent applications to reduce costs and improve efficiency within their organizations.

a. Shopping Agents

The type of agent described by Bargainbot is now termed a "shopping bot." There are numerous shopping bot companies whose online price comparison services range from music and software to cars and groceries. Examples of these services are Buy.com, Grocery shopping agency and Fido.com, [Ref. 8:Shopping Bots] the shopping doggie that sniffs out the best prices on the web. Additionally,

shopping agents like those available from Storerunner.com, [Ref. 8:Shopping Bots] are not restricted to the web, as they also check the prices offered by local "brick and mortar" stores in your area to see if they offer the better price. [Ref. 8:Shopping Bots]

Shopping bots, however, are not without controversy. Merchants are struggling with the decreasing profit margins required to stay competitive in a price-based market often flooded with competition. Frustrated, some merchants have barred bots from entering their sites. [Ref. 31] Additionally, buyers may not be getting the best overall value in their purchases that are based solely on price.

b. Best-Value Shopping Agents

A new breed of shopping agents, called best value shopping bots, may bring back those merchants if the merchants have value added into their product such as quality and service and may also bring more customers shopping. Like the standard shopping bots, some best value shopping bots focus on certain areas like "killer App," [Ref. 8:Shopping Bots] whose focus is on best value computer buying. Most, however, appear to be going the way of the one stop shopping experience like at LYCOShop. [Ref. 8:Shopping Bots]

With LYCO's system, a buyer can compare and purchase products side by side based on the merchants and features you value most. Using individual preferences, their Value-Comparison service can quickly help make even a complicated purchase decision easy. [Ref. 32] It also has the ability to compare special deals from a variety of merchants (e.g. sales or promotions) and notify the potential customer when they occur.

20-20Consumer.com [Ref. 8:Shopping Bots] is a new product on the street that offers a twist to best-value shopping bots. 20-20 is an independent consumer comparison shopping service that sifts through hundreds of stores and millions of prices for prospective buyers, updating daily. It determines best value through a past performance type rating system of suppliers based on customer satisfaction input via consumer surveys. It also offers guidance from expert and consumer product reviews. 20-20 offers access to the full range of products available on the web. [Ref. 8:Shopping Bots]

c. Auction Agents

Internet auction sites are another area of e-commerce where IA applications have proved successful. With hundreds of auction sites now in operation and new

items being posted everyday, consumers are once again left with an information gathering challenge. Agent applications like AuctionRover and Bidder's Edge [Ref. 8:Auction Bots] address this challenge and offer some variety in their method of performance. Auction Rover will email you when the items you desire become available on one of the many auctions sites and indicate the current price of the item: Bidder's Edge, however, goes a step beyond this. It offers functionality that can help you figure out what to pay and help you win the auction using "buying tools" and bots that allow the buyer to personalize the services to his or her individual needs or strategy. [Ref. 8:Shopping Bots]

There is also a reverse auction service called BidTheWorld.com [Ref. 33] that allows agencies, (to include the Federal Government) to post Requests For Proposal (RFP) and receive bids over the Internet. Because sellers bid down the price, purchasers are able to buy products and services at substantially lower prices in those areas where supplier competition exists. [Ref. 33] No fee is charged to the poster of the RFP, and a \$1.00 fee is charged to the bidder for each bid submitted.

d. Current Agent Summary

Although the agents listed here offer tremendous functionality, they represent a very small sampling of current agent applications. Today's first generation agent mediated e-commerce systems are still in an early stage of development and hold great promise for future e-commerce applications.

3. Future Vision

Negotiating agents are dominating ongoing agent based e-commerce research projects. One of the leading developers of negotiating agents is the MIT Media Laboratory. Two negotiating agents they have created are Kasbah and Tete-a-Tete. [Ref. 29] Although functional, these agents systems are still considered to be in a prototype state. A similar work is under way at the Naval Postgraduate School under the direction of Dr. Mark Nissen on a multi-agent system called the Intelligent Mall. [Ref. 34]

a. Kasbah

Kasbah is an online, multi-agent consumer-to-consumer transactions system. A user wanting to buy or sell an item creates an agent, gives it some strategic direction, and sends it off into a centralized agent

marketplace. Kasbah agents proactively seek out potential buyers or sellers and negotiate with them on behalf of their owners. Each agent's goal is to obtain an acceptable price and a date by which to complete the transaction.

[Ref. 29:p. 8] The Kasbah system also incorporates a trust and reputation agent mechanism called the "Better Business Bureau." Upon the completion of a transaction, both parties may rate how well the other party managed his/her half of the deal. Kasbah agents use accumulated ratings to determine if they should negotiate with agents whose owners fall below a user-specified reputation threshold. [Ref. 35:p. 9]

b. Tete-a-Tete

MIT's other agent prototype, Tete-a-Tete, provides a unique negotiation approach to retail sales. Unlike most other online negotiation systems, that competitively negotiate over price, Tete-a-Tete agents cooperatively negotiate across multiple terms of a transaction (e.g., warranties, delivery times, service contracts, return policies, and other merchant value added services). This negotiation takes the form of multi-agent, bilateral bargaining where a Tete-a-Tete shopping agent argumentatively negotiates with sales agents and uses

evaluation constraints to negotiate towards a pareto-optimal deal with those sales agents. [Ref. 29:p. 8]

c. Intelligent Mall

In the Intelligent Mall, agents are tasked to fill a shopping list, visit the different virtual stores of authorized vendors and negotiate purchases with store agents. As purchases are made, items are shipped to designated locations and the shopping agent's account is charged for the purchases.

d. Future Agents Summary

When one considers the tremendous amount of time and resources that can go into setting up and conducting business to business negotiations in the human environment, it is mind numbing to consider the potential costs that can be saved by negotiating agents in a virtual e-commerce environment. As the Kasbah, Tete-a-Tete and Intelligent Mall working models continue to evolve and prove themselves capable, these future e-commerce visions will very soon be a reality.

4. IA Advantages

a. Increases Efficiency

Is like an assistant that performs less complicated tasks, and allows the user to focus on the more

complicated and challenging tasks and issues. This results in a more efficient use of an actual buyer's time.

b. Saves Time

Performs tasks in seconds that could take hours or days for humans attempting to replicate the same task. In an experiment conducted at the Naval Postgraduate School, for example, agents from the Intelligent Mall were able to purchase a list of shopping items significantly faster than students shopping the same list without the benefit of agent technology (e.g., 4 minutes vs. 40 minutes). [Ref. 36]

c. Saves Money

Time saved from agent performed work directly reduces labor cost per contract. Contracts negotiated by agents reduce travel time, travel expenses and negotiation time expenses of Government and vendor negotiators, lawyers and other contracting personnel.

d. Future Requirement

With the plethora of information and commodities available on the Internet, it is just a matter of time before much of what the DoD buys will be coming from the virtual marketplace. The only feasible way to wade through all of the information is by employing IA shoppers. This

way, DoD agencies will be able to ensure they are getting the best price, and if requested, the best value and ensure the continued use of best business practices.

5. IA Disadvantages

a. Trust

It is not likely that IAs will initially be trusted to perform the tasks that were previously only performed by humans. This is a disadvantage because it will slow the implementation of this technology. Although shopping bots being used today to shop online retailers are providing a great deal of credibility to IA capability, trust will be a more significant factor with agents that may negotiate large purchases. How long will it be before an IA is trusted to negotiate the purchase of a truck for example?

b. Liability

Liability is another potential disadvantage. If the system fails to perform properly and awards a contract to the wrong vendor, the Government can expect a protest. In a protest situation, would the Government or the programmer be held responsible for such an error, and is the Government willing to accept that risk?

c. New Technology

Though IA technology has been present in e-commerce for the past several years, it is considered to be in an early stage of technological development. With any new development there will be unknown bugs that emerge and need to be worked out. Bugs usually equate to a disadvantage, at least initially.

E. SUMMARY

SPS has come along way since its inception in 1994, and it still has a way to go to enable a truly paperless procurement process. With full functionality of this evolving program expected by the year 2003, the opportunity exists for SPS to continue to implement new and innovative IT capabilities as they emerge in the exciting new world of electronic commerce. As the largest buying organization in the world, no other organization has as much to gain from innovating, streamlining and managing its procurement program than the DoD.

With the projected 95% of businesses expected to be using paperless procurement in the next three years, which coincidentally coincides with SPS's full functionality projection, there is sure to be a flood of new entrants into the procurement management industry. Lessons learned

from companies like Ariba Inc., who outperform and rise above their competition by offering features like their walk-up user interface, operating resource management tools and networking capability, may hold keys to similar successes in DoD procurement.

As the Internet continues to grow, it is becoming or in many areas has become humanly impossible to manage the inflow of information in order to maximize the potential benefit of the web. In the area of e-commerce, the increasing presence of IA's has empowered buyers to knowingly get the best price or best value, often on the buyer's terms. As this exciting technology continues to become increasingly advantageous to buyers in e-commerce, it seems prudent that the largest buying organization in the world (DoD) should closely monitor advances in IA technology. By doing so, organizations such as the Defense Logistics Agency will be able to ensure implementation of these technologies into their procurement program software, when and where it makes sense to do so.

IV. PROCESS INNOVATION

A. PHASE V: DESIGN AND PROTOTYPE THE NEW PROCESS

Process innovation is meaningful only if it improves a business in ways that are consistent with its strategy.

[Ref. 3:p. 177] The strategy of SPS is to fully develop a procurement system that will standardize all DoD procurement functions into one package. This single solution package is to fulfill the diverse procurement and contracting activities of the DoD, from purchasing office supplies, uniforms, and sundry items to weapons systems, helicopters and tanks, by revolutionizing the defense procurement world through a comprehensive paperless procurement system. [Ref. 12]

The intent of this system is to increase DoD wide procurement efficiency and capability, reduce procurement costs, and streamline the procurement process. Applying this intent with the insight gained from the previous chapters, we now begin the designing and prototyping of a new procurement process using the following steps:

- Step 1: Brainstorm Design Alternatives
- Step 2: Assess Feasibility, Risk, and Benefit of Design Alternatives and Select the Preferred Process Design
- Step 3: Prototype the New Process Design

Step 4: Develop a Migration Strategy

Step 5: Implement New Organizational Structures and Systems

Each step is addressed in turn.

1. Brainstorming Design Alternatives

The objective of brainstorming is to develop creative, but pragmatic new process designs, taking as input the process vision, change enabler and additional knowledge developed in the earlier phases of process innovation.

[Ref. 3:p. 155] To address this brainstorming activity, we discuss system needs, present an integration example, and then summarize.

a. System Needs

In order to develop a determination of the system needs, SPS disadvantages outlined in Chapter III are listed here, and serve as a rudder to guide the brainstorming effort in a direction that is intended to result in the greatest benefit of the program. The current disadvantages of SPS are 1) Y2K deployment requirement, 2) User interface, 3) not web-based, and 4) limited use of IA technologies. As the Y2K requirement deadline will pass shortly after completion of this thesis and given that a migration plan for implementation of future SPS upgrades is

already in place, we focus on finding potential solutions to the remaining disadvantages (2, 3 and 4). The goal now is to develop two sets of options, Option 1 and Option 2, which address the disadvantages with potential solutions to bring about a significant improvement in the SPS program.

(See Tables 4.1 and 4.2)

Although similar, Option 1 represents a more aggressive approach to innovating SPS than Option 2. In developing the options, we turn to the advantages noted in the discussion of Ariba Inc. in Chapter III and the attributes of IA applications in Chapters II and III.

Recall two of the major advantages of Ariba are the walk-up user interface and a web-based network system. The walk-up user interface is one of the primary features that have enabled Ariba to surpass its competitors and become the market leader. Ariba's main competitor's system took extensive training to learn to use, and was so difficult to use that even those trained to use it often tried to work around it. As this depiction of Ariba's competitor shares some resemblance to descriptions of SPS in Chapter III, [Ref. 14:p. 2] Ariba's concept of a walk-up user interface is selected as the first element of the two options.

Ariba's successful use of a web-based network system to facilitate procurement actions over the Internet resulted in an increase in procurement efficiency and a decrease in procurement costs associated with ORM. Additionally, a web-based system allows for additional functionality to be added to the system like IA's. Therefore, a web-based system is considered essential to bring innovative change to the SPS and is added to both Options 1 and 2.

The agent technologies introduced in Chapters II and III may represent the wave of the future in e-commerce. As the abundant information and resources available through the Internet continue to grow, those who are able to harness its capabilities with IAs will be able to maximize their performance. Current e-commerce agents are listed in both options, as they have a proven track record and offer good potential for improvement.

At this point, Options 1 and 2 diverge, as future e-commerce agents are only listed in Option 1. Recall Option 1 is designed to be the more aggressive of the two, and future agents represent greater risk than current agents, because they have yet to be tested in the marketplace. Another successful feature of Ariba's system that empowers

end-users to make their own purchases is the end-user access feature. This capability is the last feature added to Option 1 as it has the potential for significant cost savings in the procurement process. Thus, the addition of future-agent technologies and end-user access represents the essential difference between Options 1 and 2. Each option feature and sub-feature is now discussed in turn.

Option 1
1. Walk-up User Interface
2. Web-Based System
3. Current Agent Applications
a. Help Agent (Clippit)
b. Search Agent
c. Shopping Agent
d. Reputation Agent
e. Best Value Agent
f. Auto-tracking
g. Update Agent
4. Future Agent Applications
h. Negotiating Agent
5. End-user Access

Table 4.1. Brainstorm Option 1

Option 2
1. Walk-up User Interface
2. Web-Based System
3. Current Agent Applications
a. Help Agent (Clippit)
b. Search Agent
c. Shopping Agent
d. Reputation Agent
e. Best Value Agent
f. Update Agent
g. Auto-tracking

Table 4.2. Brainstorm Option 2

(1). Walk-up User Interface

The first step in innovating the SPS is to develop a walk-up type interface, similar to that used by Ariba Inc., that will allow for the projected 44,000+ users to employ the system efficiently and without excessive initial or remedial training. If a system is filled with functionality, but the user interface makes the system difficult to use, operational efficiency cannot be maximized. Before adding additional functionality to the system, operability should be considered.

(2). Web-Based: The next step in innovating the SPS is to move from the regional server system to a web based system. Plans for a web-based system are reportedly [Ref. 37] in the works at SPS, but information on an approximate time frame is not presently available. A web-based system will enable SPS and its users to take full advantage of the power of the Internet. It will allow for the smooth transfer of documentation from initiator to supervisor to vendor and if need be, back and forth to legal or the end-user, as described in Chapter III. Additionally, a web-based system opens the doors to increased functionality like intelligent agent applications

that have the ability to innovate the procurement process by working as assistants to contracting personnel.

(3)/(4). Current/Future Agent Applications:

In addition to allowing for a smooth and efficient transfer of documentation, a web-based program allows for the exchange of information and actions. It is this capability that is required for SPS to further implement IA technologies in order to reap the benefits discussed above. Specific areas that could benefit from the implementation of the IA type technologies are presented in Table 4.3.

Table 4.3 is a modification of Table 3.1.

The agents are matched with the applicable steps in the FAP as indicated in the table. The capability of the agent is matched with a step in the process that is parallel to the function of the agent listed, based on the description. The second column in the table is unchanged from above and is provided for reference. Column three indicates whether or not the step is a candidate for one of the agent applications discussed earlier in this thesis. It is marked by a "C" or an "F" to indicate if the agent is a current or a future capability. Column four identifies the type of agent technology that could perform the task, and

SPS with Agent Candidates

Phase I Acquisition Planning				
FAP Function	SPS (Current)	IA Step	Type of Agent	Web-Base Required
A. Determination of Need				
1. Forecasting Requirements	0			
2. Acquisition Planning	0			
3. Purchase Requests	+			
4. Funding	0			
5. Market Research	0	C	Update or Auction Agent	Yes
B. Analysis of Requirement				
6. Requirements Documents	+			
7. Use of Government Property/Supply Sources	+			
8. Services	-			
C. Extent of Competition				
9. Sources	+			
10. Competition Requirements Unsolicited Proposals	0			
11. Set-Asides	+			
12. 8(a) Procurements	+			
D. Source Selection Planning				
13. Lease vs. Purchase	-	C	Best Value Agent	Yes
14. Price Related Factors	-	C	Shopping Agent	Yes
15. Non-Price Factors	-	C	Best Value Agent	Yes
16. Method of Procurement or Purchasing	0	C	*Auto Contract logic	No
E. Solicitation Terms & Conditions				
17. Contract Types— Pricing Arrangements	+	C	*Auto Clause logic	No
18. Recurring Requirements	0			
19. Unpriced Contracts	-			
20. Contract Financing	0			
21. Need for Bonds	0			
22. Method of Payment	0			
23. Procurement Planning	+			

(C) = Current technology

(F) = Future technology

(*) = Existing SPS agent application

(+) = SPS automates and performs

(0) = SPS only supports

(-) = SPS does not automate or support

Table 4.3. SPS Agent Candidates

SPS with Agent Candidates

Phase II - Contract Formation				
FAP Function	SPS (current)	IA Step	Type of Agent	Web-Base Required
F. Solicitation of Offers				
24. Publicizing Proposed Contract Actions	+	C	Search Agent	Yes
25. Oral Solicitation	-			
26. Solicitation Preparation	+			
27. Pre-Award Inquiries	+			
28. Prebid/Prequote/ Preproposal Conferences	-			
29. Amending/ Canceling Solicitations	+			
G. Bid Evaluation				
30. Processing Bids	-	C	Best Value Agent	Yes
31. Bid Acceptance Periods	-			
32. Late Offers	-			
33. Price Analysis —Sealed Bidding	-	C	Best Value Agent	Yes
34. Responsiveness	-	C	Reputation Agent	Yes
H. Proposal Evaluation				
35. Processing Proposals	+	F	Negotiating Agent	Yes
36. Applying Non-Price Factors	0	C	Best Value Agent	No
37. Price Analysis-Negotiations	0	C	Search Agent	Yes
38. Pricing Information From Offerors	+	C	Best Value Agent	Yes
39. Audits	+			
40. Cost Analysis	-	C	Shopping Agent	Yes
41. Evaluating Other Offered Terms/Conditions	0	C	Best Value Agent	Yes
42. Award Without Discussions	+			
43. Communications/Fact-finding	+			
44. Extent of Discussions (Competitive Range)	0			
45. Negotiation Strategy	0			
46. Conducting Discussions/Negotiations	-	F	Negotiating Agent	Yes

Table 4.3. SPS Agent Candidates (Continued)

column five indicates if a web-based operating system is required for the agent to function optimally.

(5). End-user Access: End-user access to SPS will allow end-users to make purchases on their own desk top computers, up to a certain dollar threshold. Whether the threshold level should be \$10,000 or up to \$100,000 is a topic for further research and goes beyond the scope of this thesis.

b. Integration Example

Once all of the system features from above are in place, one can begin to realize the capability of the new system. As an example of how this prototype process would operate, consider a new truck required for a military base. Projecting the manner in which this agent-enhanced SPS would function, we outline the key activities associated with applicable federal procurement processes: 1) determination of need, 2) source selection planning, 3) solicitation of offers, 4) bid evaluation, 5) proposal evaluation, and 6) contract award. The last item, number (7), lists additional system features and completes the integration example.

(1). Determination of Need: The market research agent will go out on the web and search for

information on the type of truck that is requested and come back with information ranging from price to reliability, depending on the parameters specified by the user. This information can be provided as raw data or can be synthesized by the agent, which could then provide recommendations. This report, like all agent reports, is generated in a matter of minutes.

(2). Source Selection Planning: In source selection, best value and standard shopping agents are able to search the web to determine which source provides the best value to the government and again make recommendations accordingly. This need not be limited to online retailers, as agents can search local brick and mortar businesses that sell trucks as well (As noted in Chapter III).

(3). Solicitation of Offers: Under solicitation, proposals are not only sent out over the Internet to the Commerce Business daily, but they are also received over the Internet and screened for eligibility to participate in a Government contract by a search agent that scans the database of Government authorized vendors. If eligible, the paperless proposal or bid is forwarded for evaluation. If not, the vendor is sent an immediate notification response.

(4). Bid Evaluation: Bid evaluation, a process task which is currently performed manually, can now be processed instantly, as shopping agents are proficient at determining best price and best value. When bids are received over the Internet, the agents can analyze the bids and determine which vendor is offering the best price. With reputation agents included in this step, only responsive and responsible vendors will be able to win a bid.

(5). Proposal Evaluation: As proposal evaluation is significantly more difficult a task than evaluating bids, human involvement or a higher level negotiation type agent technology would be required for processing proposals. Nonetheless, standard shopping or price analysis and best value agents will still assist in determining which proposal offers the best overall value to the Government. A multi-agent system similar to Kasbah would be ideal in this case.

If negotiations are required to complete the contract, negotiating agents similar to Kasbah and Tete-a-Tete or the Intelligent Mall can conduct the negotiation with the vendor's negotiating agent to reach a fair deal on the truck. Such a deal may include a warranty and

maintenance package and special preferred customer discounts, for example. This may all occur within minutes and in accordance with the established parameters. There should not be a lot of room to negotiate on this particular deal, however, because of the thorough market research conducted earlier in the day by the market research agent.

Although negotiating agent technology is still in the prototype stage, it is considered a viable option for future SPS implementation, as the current SPS implementation plan is scheduled through 2003.

(6). Contract Award: The contract can now be awarded, and upon the receipt of the new truck, the funding can be sent directly to the vendor's online account as applicable (e.g., depending on a lease or buy decision). The buyer's account would then be debited, and an electronic record of the transaction would be maintained.

(7). Additional System Features: A Help agent would be ever present to provide guidance and information to the contractor, just as Microsoft's Clippit agent does in its windows product line of operating systems.

Due to the web-based feature, the progress of the acquisition could be tracked in a manner similar to

the tracking of a parcel sent via Federal Express, and as is performed in Ariba's system. That way, all persons involved in the contract, including the end-user, can instantly receive an up-to-date status of the progress of the purchase, or if preferred, hourly or daily updates could be sent directly to the inquirer's email account via an update agent.

With all the functionality listed in this section in place, it is reasonable to imagine that an end-user with minimal training could access the SPS, enter the descriptive information of the purchase request, and allow the new system to process the request. In performing this task, agents would refer to required regulations and best business practices, and they could make best value recommendations or purchases from the authorized vendor that offers the best deal.

c. Brainstorm Summary

A system that is user friendly, web-based and incorporates the agent technology listed above holds the potential to significantly change the way contract processing is performed in the DoD. This change does not intend to replace contacting personnel. Rather, it is designed to assist them with agents performing contacting

tasks where it makes sense to do so and leave alone those tasks where it does not.

2. Assess Feasibility, Risk and Benefit

As part of step 2 in this section, we assess the feasibility, risk and benefit of each feature for Option 1 (listed in Table 4.1), keeping in mind that features for Option 2 (from Table 4.2) represent a subset of Option 1. Upon completion of the assessment, the preferred option is selected as the new process design.

a. Feasibility

As we assess feasibility, the goal is to determine the reasonable likelihood of the selected features being implemented into the SPS. Each of the features from Table 4.1 is discussed in turn.

(1). Walk-up Interface: In determining if a walk-up interface is feasible for SPS, we look to what Ariba Inc. has been able to achieve with its paperless contracting system. People at Ariba have created an interface that is intuitive enough to be used not only by contracting personnel, but also by occasional end-users. This capability has enabled Ariba to surpass its primary competitor whose program offered similar functionality, but was more difficult to operate. As SPS requires more

functionality in its system than Ariba in order to meet the requirements inherent to Government contacting, Ariba's system may not serve as a perfect fit for SPS. But, the fact that Ariba has successfully implemented its system suggests this feature would also be feasible for SPS.

(2). Web-based System: The feasibility of a web-based system is again established by the success of Ariba Inc., as this has allowed for open communication and routing channels for business to business e-commerce. AMS, the provider of PD2, echoes the feasibility of a web-based system, as its management recommends their aquiline product to PD2 users to provide this capability. The fact that SPS officials are planning to implement a web-based capability in a future version of SPS suggests the feasibility for the SPS as well.

(3). Current Agent Applications: The feasibility of the agents listed in the two prototype options from above has been proven in existing e-commerce applications. As SPS is an e-commerce type function, it seems feasible that these agents will be adaptable to the SPS.

(4). Future Agent Applications:
Negotiating agents have been demonstrated in prototype and

trial applications. As advances in the IA software industry continue to occur at a rapid rate to meet the need and demand of the e-commerce revolution, it is reasonable to suggest negotiating agents also represent feasible candidates for future SPS applications. The feasibility of this feature being ready for implementation into SPS by the time version 5.0 is fielded, however, is low.

(5). End-User Access: End-users in hundreds of fortune 500 companies are currently able to make purchases of products and services from their desktop computers via Ariba's procurement system. This suggests it is likewise feasible that a similar capability could be developed for end-users in the DoD for certain types of purchases under specified thresholds.

b. Risk

The notion of risk is the probability or likelihood of some resulting harm. [Ref. 38] Although admittedly subjective, the features listed in Table 4.1 are now assessed for risk and the likelihood of resulting harm. Risk is categorized as minimal, medium or high for each feature.

(1). Walk-up Interface: As Ariba provides an existing and successful model, and the interface is

reportedly a problem with PD2, the risk involved with staying with the current structure exceeds the risk of improving it. Risk of implementing an improved interface system is therefore rated as minimal.

(2). Web-based System: The primary risk factor associated with implementing a web-based system into SPS involves security. As existing commercial e-commerce applications have been accepted and used by a multitude of consumers, safely allowing for millions of data and purchase transactions to be conducted in a secure mode over the Internet everyday, online security does not represent a high risk in e-commerce. Although hackers will always be a threat, use of existing security system software should be sufficient for most SPS transactions. Risk is therefore regarded as minimal.

(3). Current Agent Applications: There is always risk involved when trying something new, as was the case in the development of SPS. Although many agents have been proven effective individually, the researcher could not find information to indicate if a multi-agent system of the proposed magnitude was currently in use in the commercial sector. The Kasbah and Intelligent Mall prototypes are multi-agent systems that lend credibility to

the argument that it is feasible, but as prototypes, it is not sufficient to rule out possible risk. There is also potential risk of liability for agents that perform illegally or select/recommend other than the best offeror. As agents can only process inputted information using inputted parameters, an error is more likely to occur due to human error than IA error. Risk is therefore considered medium.

(4). Future Agent Applications: Greater risk lies with negotiating agents that create legally binding contracts. The more autonomous these agents become, the greater will be the risk. Parameters will have to be established that limit the amount of funds the agent is authorized to award, and these will need to be in place prior to negotiation. As this level of agent capability is yet unproven in the commercial sector, though supported in theory with functional prototypes, future agent capability at this time is assessed to present a high risk to the SPS.

(5). End-User Access: As with any delegation of authority, there is inherent risk in whether that task will be performed to the appropriate standard. Delegating authority to end-users to make certain purchases

or contracts that were previously only conducted by contracting offices will create procurement risk.

Additionally, a user-friendly interface that requires minimal training is a pre-requisite to this feature being implemented, as it is not cost effective to provide extensive training to occasional users. As current agent features will aid in decision-making and legal compliance, this should also be considered a prerequisite to end-user access. Until these assets are approved and in place, the risk involved in end-user access is considered high.

c. Benefit

As we assess the benefits of these same features, the goal here is to determine what advantage is to be gained by implementing each feature. Again, we start with walk-up interface and continue through end-user access.

(1). Walk-up Interface: This feature will allow for greater operator efficiency and productivity in the performance of procurement duties. Operators will feel comfortable using the system and will not try to work around it. It may reduce procurement process time, which could result in a process cost savings. As the interface becomes more user-friendly, it is reasonable to expect that

end-users may benefit as well, for example, by using the system to purchase authorized catalog items (just as Ariba users are able to do). This too may reduce procurement cost via preferred vendor pricing and reduction in processing expense.

(2). Web-based System: This feature will allow for smooth transfer of information to all participants involved in the contracting process, allowing SPS to enable a paperless process. It also opens the doors to increased functionality like intelligent agent applications that have the ability to innovate the procurement process by working as assistants to contracting personnel. Reduced process time and reduced processing costs, along with increased efficiency and user satisfaction, are the expected benefits.

Additionally, a web-based system may empower contracting personnel to take full advantage of available resources and databases. Additional relevant information that could range from global product price to vendor/contractor past performance information could be instantly drawn from a federal database. This could help ensure the best price from the most reliable vendor.

(3). Current Agent Applications: These agents offer the ability to increase efficiency of contracting personnel and significantly reduce the cycle time required to complete a contract by performing agent specified tasks in the procurement process. Tasks that previously took a large percentage of contracting personnel's time may now be performed nearly instantly by agents and allow contracting personnel to focus on more demanding tasks.

In addition to reducing cycle time, significant cost saving benefits may also be realized in allocated labor hours per contract processed. End-user satisfaction may further be increased, as reduced process time equates to quicker delivery. As the user interface becomes more user friendly and agent technology continues to progress, end-users may be able to make purchases of increasing difficulty, as agents will be available to ensure that their actions stay within the law.

(4) Future Agent Applications: Negotiating agents may offer the greatest benefit when considering procurement innovation, as they have the potential to autonomously negotiate contracts for goods and services with vendor agents in a virtual environment, based on

buyers' directions and previous actions. The savings of time and resources involved with this type of agent resource could prove to be of great benefit to future contracting.

(5). End-User Access: As most end-users have a good idea of what they want in a product or service, they would reasonably benefit from the ability to make their own purchases, as they could describe or select what is needed first hand. Additionally, this would save time and money, as there is additional processing time and cost associated with using a mediator (e.g., contracting office) to process a purchase request. Contacting offices may also benefit from end-user purchases, as contracting personnel could then be employed on more significant and less repetitive purchases.

d. Design Selection

The issue now becomes, what is really needed by SPS as its designers further develop their vision for world class procurement? There are literally thousands of features that could be employed in such a huge procurement program, as the researcher understands SPS is well aware of and has long been dealing with this very issue. Only those features that are able to add the greatest value to the

program in usability and functionality can be employed. Otherwise, the system becomes overburdened with too many features. Based on the analysis, at the present time, Option 1 is the least favorable choice due to the risk associated with the negotiating agent and end-user access features. Although certain levels of risk are encouraged for innovative change, and the potential benefit of negotiating agents and end-user access is positive, there is not enough compelling gain to implement these features at this time. There is, however, sufficient rationale to support an effort for additional study of these features for future employment.

As Option 2 excludes negotiating agents and end-user access, the features listed in this option offer the greatest value for current innovative change to the SPS. The features contained in Option 2 (listed in Table 4.2) will allow SPS to best meet the intent of the current program, which is to increase DoD wide procurement efficiency, reduce procurement costs, and streamline the procurement process.

3. Prototype the New Process

The term prototype, in the DoD Dictionary of Military Terms, is defined as: a model suitable for evaluation of

design, performance, or production potential [Ref. 39].

The selected features to be implemented into this prototype are those contained in Option 2. For reference, they are a) walk-up interface, b) web-based system, and c) current agent applications. Each is presented in turn and, with the exception of walk-up interface, a conceptual model is presented that depicts the added functionality.

a. Walk-up Interface

As SPS prepares to meet the user requirements of 44,000 contracting personnel and 1,100 buying offices, this feature will be key for reducing training requirements and increasing usability. Although a graphical walk-up model is not presented in this work, access to additional information on Ariba's walk-up user interface solution is available from Ariba's web-site at www.ariba.com.

b. Web-based System

As depicted in Figure 4.1, a web-based system will allow for instant access and smooth transfer of information and documents with all participants and resources involved in the process.

This additional capability empowers contacting personnel with significantly greater amounts of relevant information than ever before. This will allow for

operators to make the buy that provides the best value to the Government.

Web-Based SPS Prototype

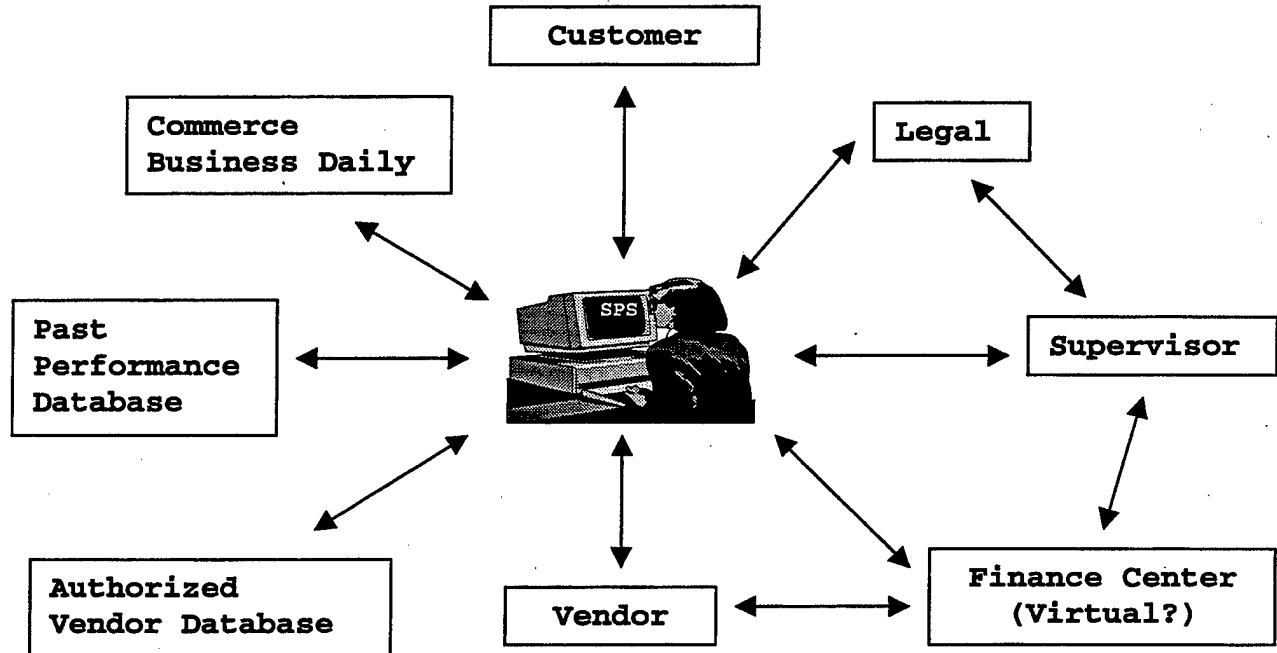


Figure 4.1 Web-based SPS Prototype

c. Current Agent Applications

Dealing with the wealth of information generated by fully tying into the Internet is where intelligent agents offer tremendous value. Agents can work in concert with contracting personnel, synthesizing the data into pertinent information and providing logical recommendations to their controllers.

In Table 4.3, two existing agent applications in the SPS, along with thirteen current agent applications and two future agent applications for SPS, are matched with similar functions in the FAP. Now that Option 2 has been selected as the superior design for innovating the SPS, Table 4.3, minus future agent applications, represents the new design prototype.

By grading the functionality of the new SPS prototype in the same manner outlined for Table 3.1, ten areas of the SPS now have performance grades that are higher than the benchmark grade of the current SPS, as indicated below in Table 4.4. These include market research, lease vs. purchase, price-related factors, non-price factors, processing bids, price analysis-sealed bid, responsiveness, applying non-price factors, price analysis-negotiations, and cost analysis. This suggests that the functionality of SPS can be significantly improved through the implementation of the current agent technologies listed in Option 2. However, notice that three current agent application grades did not increase. The grades in those areas were already maximized. These include publicizing proposed contract actions, pricing information from offerors, and audits.

Prototype of SPS Functions in the FAP

Phase I. Acquisition Planning				
FAP Function	SPS (Current)	IA (Current)	SPS Performs (Prototype)	IA Assisted (Prototype)
A. Determination of Need				
1. Forecasting Requirements	0		0	
2. Acquisition Planning	0		0	
3. Purchase Requests	+		+	
4. Funding	0		0	
5. Market Research	0		+	Yes
B. Analysis of Requirement				
6. Requirements Documents	+		+	
7. Use of Government Property/Supply Sources	+		+	
8. Services	-		-	
C. Extent of Competition				
9. Sources	+		+	
10. Competition Requirements Unsolicited Proposals	0		0	
11. Set-Asides	+		+	
12. 8(a) Procurements	+		+	
D. Source Selection Planning				
13. Lease vs. Purchase	-		+	Yes
14. Price Related Factors	-		+	Yes
15. Non-Price Factors	-		+	Yes
16. Method of Procurement or Purchasing	+	Yes	+	Yes
E. Solicitation Terms & Conditions				
17. Contract Types— Pricing Arrangements	+	Yes	+	Yes
18. Recurring Requirements	0		0	
19. Unpriced Contracts	-		-	
20. Contract Financing	0		0	
21. Need for Bonds	0		0	
22. Method of Payment	0		0	
23. Procurement Planning	+		+	

(+) = SPS automates and performs
 (0) = SPS only supports
 (-) = SPS does not automate or support

Table 4.4. Prototype of SPS Functions in the FAP

Prototype of SPS Functions in the FAP

Phase II: Contract Formation				
FAP Function	SPS (Current)	IA (Current)	SPS Performs (Prototype)	IA Assisted (Prototype)
F. Solicitation of Offers				
24. Publicizing Proposed Contract Actions	+		+	Yes
25. Oral Solicitation	-		-	
26. Solicitation Preparation	+		+	
27. Pre-Award Inquiries	+		+	
28. Prebid/Prequote/ Preproposal Conferences	-		-	
29. Amending/ Canceling Solicitations	+		+	
G. Bid Evaluation				
30. Processing Bids	-		+	Yes
31. Bid Acceptance Periods	-		-	
32. Late Offers	-		-	
33. Price Analysis —Sealed Bidding	-		+	Yes
34. Responsiveness	-		+	Yes
H. Proposal Evaluation				
35. Processing Proposals	+		+	
36. Applying Non-Price Factors	0		+	Yes
37. Price Analysis-Negotiations	0		+	Yes
38. Pricing Information From Offerors	+		+	Yes
39. Audits	+		+	Yes
40. Cost Analysis	-		+	Yes
41. Evaluating Other Offered Terms/Conditions	0		0	
42. Award Without Discussions	+		+	
43. Communications/Fact-finding	+		+	
44. Extent of Discussions (Competitive Range)	0		0	
45. Negotiation Strategy	0		0	
46. Conducting Discussions/Negotiations	-		-	

Table 4.4. Prototype of SPS Functions in the FAP(Continued)

With the auto-tracking agent added in, the burden of persistent contract status inquiries may also be reduced, as authorized personnel can instantly access the information over the Internet.

The prototypes depicted, both verbally and graphically above, represent an innovative change to the SPS system. They embody some of the best features of emerging e-commerce technologies and apply them to the Federal acquisition process and the functions of the SPS. As the SPS program continues to evolve, features listed in this limited prototype serve as prime candidates for future versions of the system. It is also the type of innovation the 106th Congress is pursuing in section 812 of the FY 2000 National Defense Authorization Act, as it requires the DoD to develop a program to increase business innovation in Defense acquisition programs [Ref. 40:p. 198]

4. Develop a Migration Strategy

SPS already has a migration strategy in place for the next three years, as presented in Figure 3.4, so a new migration strategy for existing SPS functionality is not presented here. Alternatively, the Option 2 features must be incorporated into the migration strategy. A logical ordering of these features would follow that of their

presentation and discussion in this section (i.e., first incorporate feature 1, then 2, and finally 3).

5. Implementing New Organizational Structures and Systems

As SPS is the system that represents the innovative lever for change to the manual procurement system, no changes to the organization are recommended at this time. The new system recommended is a web-based system. A web-based system is reportedly being implemented in a future version of SPS.

C. SUMMARY

The analysis of this chapter begins with phase V of Davenport's process innovation framework, designing and prototyping the new process. With the understanding that SPS is the lever for changing the face of Government contracting, this analysis focused on possible innovative changes to the SPS. As SPS enters the next century, bold and innovative changes to the system may be required in order for the DoD procurement effort to keep pace with the commercial sector. More important, however, is the need to take advantage of the information, resources and functionality available in e-commerce solutions that promise to minimize Government cost and maximize

procurement efficiency. A walk-up user interface, a web-based system and current IA applications in e-commerce are proven to be feasible solutions to meet this need.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

As discussed in Chapter I, the purpose of this thesis is to provide analysis of DoD's Standard Procurement System and determine if applications from paperless contracting systems like Ariba and e-commerce IA applications could hold the potential for innovative change in the SPS.

The literature review conducted in Chapter III on each of the three areas reveals advantages and disadvantages to each. Many of the advantages found in Ariba and the IA research stem from current technologies that are credited with driving the e-commerce industry to new heights, as the value of these advantages is realized in the business to business and business to consumer markets.

Through this research and analysis, five major areas are considered for innovating the SPS. These include the following: 1) walk-up user interface, 2) web-based system, 3) current agent applications, 4) future agent applications, and 5) end-user access to SPS. Areas 4 and 5 represent the greatest risk at this time. Area 4 is risky because of the lack of software maturity and liability issues. Area 5 is risky in part due to the inherent

problems associated with delegation, but also because areas 1-3 are prerequisites to its implementation.

Alternatively, areas 1-3 represent current technologies that pose relatively less risk to the SPS program.

Additionally, they represent feasible technologies and have the potential to benefit the SPS by simplifying and streamlining the acquisition process, as well as reducing costs and empowering contracting personnel.

If analysts are correct in their prediction that by 2003, business to business e-commerce will grow to \$1.3 trillion and 95% of business industry is going to go to paperless procurement, [Ref. 11] only an aggressive implementation of innovative technologies today will prepare SPS for the procurement needs of tomorrow. These areas listed above will be key in developing the next generation of procurement application software designed to link acquisition reform and common DoD procurement business processes with commercial best practices and advances in electronic commerce [Ref. 2].

It is not the intent of this work to detract from the tremendous effort that has brought this world class program to fruition. Today's SPS is the base from which DoD procurement processes of the future will emerge. The

insightful pioneers of this program and those who championed the fight for its existence successfully opened the doors to the future of Government contracting. It is this same insightful energy that must be carried forward as future versions of SPS are considered. And indeed, this has been the case, as future SPS implementation plans are filled with greater functionality and leading edge technology.

These plans also list several features that are similar to some of those recommended in this thesis (e.g., Web-based system, vendor performance data and automated best value). Therefore, this analysis augments these SPS efforts by adding support to existing ideas, and it recommends additional areas for consideration. Hopefully it will also serve as a catalyst for further research in this area.

Just days before this thesis is submitted for final signature, Ariba and AMS have announced a partnership between the two companies. Together they plan to offer the first comprehensive, Government-to-business e-commerce solutions. [Ref. 41] Although the specific details of this partnership are still in the works, company spokespeople do say that they plan to integrate the Ariba solution into

existing AMS Federal customer installations. [Ref. 41] This is indeed good news for Government procurement.

B. ANSWERS TO RESEARCH QUESTIONS

1. Answer to Primary Research Question

What areas of the Standard Procurement System can best be innovated with emerging e-commerce technologies?

As a result of the analysis in Chapter IV, at present, the emerging e-commerce technologies that can best innovate the SPS are 1) a walk-up user interface, 2) a web-based system, and 3) current agent applications. The current agent applications are the a) Help Agent, b) Search Agent, c) Shopping Agent, d) Reputation Agent, e) Best Value Agent, f) Update Agent, g) Auto-tracking.

2. Answers to Secondary Research Questions

Brief answers to the secondary questions are presented here, as full explanations are presented in Chapter III.

a. What is the Standard Procurement System and what are DoD's paperless procurement requirements?

- The Standard Procurement System (SPS) is the next generation of procurement application software designed to link acquisition reform and common DoD procurement business processes with commercial best practices and advances in electronic commerce. The

requirement is to develop a standard system for the procurement of goods and services to be used by all DoD agencies. When fully implemented, it will serve more than 1,100 sites worldwide and be employed by over 44,000 professionals.

b. What are the advantages and disadvantages of the SPS?

- The advantages of the SPS are that a) it is an automated system, b) it has a future deployment plan in place, and c) it has a broad range of functionality.

- The disadvantages of the SPS are a) the Y2K deployment requirement, b) the difficult user interface c) that it is not web-based, and d) the limited use of intelligent agent technology.

c. Who is Ariba Inc. and why is their paperless contracting system so successful with Fortune 500 companies?

- Ariba Inc. is a frontrunner in the business to business e-commerce market. Ariba software and services automate the internal and external commerce processes linking buyers, suppliers and value-added service providers through a global e-commerce infrastructure to

provide cost savings and revenue opportunities for businesses of all sizes. The focus of their paperless procurement system is on Operational Resources Management (ORM). By controlling these costs, a minimum 10% saving is expected. For a fortune 500 company that annually spends \$500 million in OR, \$50 million in savings could be realized.

d. What are the advantages and disadvantages of Ariba?

- The advantages of Ariba are that it a) uses a walk-up user interface, b) incorporates a preferred buyers/suppliers relationship, c. reduces maverick buying, d) uses a web-based network system.

- The disadvantages of Ariba are that it a) doesn't deal with regulations, and b) offers a limited source of supply.

e. What are intelligent agents and what effects are they having on the e-commerce industry?

- Intelligent agents are software applications that assist people and act on their behalf. Intelligent agents work by allowing people to delegate work that they could have done, to the agent software. Agents can, just as assistants can, automate repetitive tasks,

remember things you forgot, intelligently summarize complex data, learn from you, and even make recommendations.

- As the Internet continues to grow, it is becoming or in many areas has become humanly impossible to manage the inflow of information in order to maximize the potential benefit of the web. In the area of e-commerce, the increasing presence of IA's has empowered buyers to knowingly get the best price or best value, and far quicker than ever before possible.

f. What are the advantages and disadvantages of these agents?

- The IA Advantages are that they a) increase efficiency, b) save time, c) save money, and d) are likely to be a future requirement.

- The disadvantages to IAs are the a) willingness of users to trust autonomous agents, b) liability involved with doing so, and c) new technology with unknown potential problems/issues.

C. RECOMMENDATIONS

Based on the conclusions above, the thesis offers five recommendations for action: 1) explore the possibility of a walk-up interface capability for SPS; 2) make implementation of a web-based system into SPS a top

priority; 3) develop an implementation strategy for the integration of agent technologies into SPS; 4) coordinate with Naval Postgraduate School faculty to guide future research and SPS development; and 5) pursue development of negotiating agent capability. Each recommendation is outlined in turn.

1. Explore possibility of a walk-up interface capability for SPS

With AMS training teams teaching more than 30 classes each month worldwide, [Ref. 12:p. 9] and with over 15,000 current users, monthly classes would have to triple in the next three years in order to meet the requirements of 44,000 worldwide users in over 1,100 locations. Just the possibility of reducing some of the expense of the instruction requirement would rationalize the effort of an exploratory look into whether or not an Ariba type walk-up interface capability is possible for SPS.

2. Make implementation of a web-based system into SPS a top priority

SPS should shift to a web-based system as soon as is reasonably possible so that additional functionality and agent integration (e.g., as described in Chapter IV) can begin to be realized. This should increase user

satisfaction, as processes can be performed more efficiently, reducing workload and empowering users with increased information resources.

3. Develop an implementation strategy for the integration of agent technologies into SPS

As a web-based system is required to obtain optimal performance from the agents listed in Option 2 and Figure 4.4, a strategy should be developed to integrate the agent applications into SPS after the web-base is established.

4. Coordinate with Naval Postgraduate School faculty to guide future research and SPS development

As SPS is at the forefront of future acquisition processes, the very nature of the program draws interest from faculty and students at the Naval Postgraduate School. And through research, faculty and students offer a capability to investigate many technologies, systems, strategies and management practices with great potential to guide and assist successive SPS developments and releases.

5. Pursue development of negotiating agent capability

With regard to negotiating agents in Government contracting, it is not a matter of if, but a matter of when and to what level, negotiating agents will be employed in this function. Although independent work on the

Intelligent Mail is being conducted at the Naval Postgraduate School (NPS), a focused effort with funding is recommended toward this type of work to fully develop this capability.

Another option is to get involved with the work being conducted at MIT Laboratories where the Kasbah and Tete-a-Tete prototypes are being created. A joint NPS-MIT venture may be cost effective and helpful, as Government contracting has unique features that are not well understood in the commercial sector. Working such collaboration into early prototypes could prove to be highly beneficial to the Government.

C. RECOMMENDATIONS FOR FUTURE RESEARCH

This thesis has addressed a number of important issues pertaining to acquisition and SPS. But substantial research remains to be done. Building on the results of this thesis work, a number of recommendations for future research are outlined below.

1. Post-Award Investigation

The scope of this research is limited to the pre-award phase, from determination of need to contract award. Future research may benefit by adopting much of the same format, and focusing instead on the post-award phase, from

contract award to contract closeout. This represents a logical progression from this research, which should bring to light additional areas in the SPS that are equally ripe for innovation.

2. End-user SPS Access

Future research should also investigate further development of the SPS to expand the base of acquisition personnel able to benefit from the system. For example, the system could be expanded for use by all DoD authorized purchasers, including supply personnel and end-users. As SPS capability continues to grow, opportunities to take advantage of economies of scale through a worldwide cataloged procurement system will increase.

The key to such expansion may depend on the system also including micro-purchases, so that more Government purchases can be made from preferred vendors at reduced prices, avoiding maverick buying. All authorized vendors would be encouraged to list their products or services in virtual DoD catalogs. As more vendors become involved, DoD may be afforded lower prices due to enhanced competition, Government buyers may be able to wade quickly through the thousands of vendors to find the best price on

the item they need with shopping and best value agents. Research is required to explore these issues further.

3. Joint Theses with IT Students

By linking Systems Management students with IT students, very promising joint thesis opportunities exist. For example, a joint team may be able to create a prototype or working model of Government agents that conduct market research or solicit and evaluate bids for products or services. Such development requires both technical and acquisition knowledge. By combining IT students' software development knowledge with acquisition students' Government procurement knowledge, a robust and responsive new capability can result.

4. Negotiating Agents in DoD Contracting

Several theses can be dedicated to the issue of negotiating agents in DoD contracting. In addition to the issues of trust, risk and liability, the research should include agent strategies, parameters, and multi-agent functions that conduct market research, best value and past performance. Government procurement laws that may pertain to such a program can also be addressed.

APPENDIX A. FEDERAL ACQUISITIONS PROCESS

PHASE I: ACQUISITION PLANNING PHASE

1. Determination of need.

1. Forecast requirements for supplies and services.
2. Develop an acquisition plan.
3. Receive and process purchase requests.
4. Acquire Funding.
5. Conduct market research.

2. Analysis of requirement.

6. Review requirements document.
7. Identify and justify use of Government furnished property and supply sources.*
8. Evaluate personal and non-personal services.

3. Extent of competition.

9. Identify authorized potential sources.
10. Ensure competition and unsolicited proposals requirements are met.
11. Determine if contract (K) should be a small business Set-aside.
12. Determine feasibility of 8a (Small Business Administration Program) procurement.

4. Source selection planning.

13. Evaluate lease vs. purchase benefits.
14. Evaluate price-related functions.
15. Evaluate Non-Price factors.
16. Determine method of procurement or purchasing.

5. Business terms and conditions.

17. Determine contract type and pricing arrangement.
18. Establish recurring requirements program.*
19. Establish a letter or unpriced contract.*
20. Determine if financing is necessary and type of financing required.
21. Establish bond program.*
22. Determine method of payment.

APPENDIX A. FEDERAL ACQUISITIONS PROCESS (Continued)

23. Complete the procurement plan.

PHASE II: CONTRACT FORMATION PHASE

1. Solicitation of offers.

- 24. Publicize proposed contract actions.
- 25. Conduct oral solicitations.**
- 26. Prepare solicitation.
- 27. Reply to preaward inquiries.
- 28. Hold prebid/prequote/preproposal conferences. **
- 29. Amend and cancel solicitations.***

2. Bid evaluation.

- 30. Process bids.
- 31. Monitor bid acceptance period dates.
- 32. Resolve late offer issues.
- 33. Conduct price analysis of sealed bids.*
- 34. Determine offeror responsiveness.

3. Proposal evaluation.

- 35. Process proposals.
- 36. Apply non-price factors (Technical evaluation).
- 37. Conduct price analysis and negotiations.
- 38. Evaluate pricing information from offerors.****
- 39. Conduct audit on offerors.****
- 40. Conduct cost analysis.
- 41. Evaluate other offered terms and conditions.*
- 42. Award without discussion.**
- 43. Conduct fact-finding. ****
- 44. Establish a competitive range.
- 45. Develop a negotiation strategy.
- 46. Conduct discussions/negotiations.

4. Contract Award.

- 47. Debrief unsuccessful offerors.
- 48. Determine responsibility of offeror.

APPENDIX A. FEDERAL ACQUISITIONS PROCESS (Continued)

- 49. Consider subcontracting requirements.*
- 50. Prepare award.
- 51. Issue award and notices.
- 52. Resolve mistakes in offers.*
- 53. Resolve protests.

PHASE III: CONTRACT ADMINISTRATION PHASE

1. Initiation of work and modifications.

- 54. Prepare a contract administration plan.
- 55. Conduct post-award orientation.**
- 56. Issue consent to subcontract.**
- 57. Establish subcontracting requirements.*
- 58. Make contract modifications.***
- 59. Exercise contract options.**
- 60. Utilize task and delivery order contracts.*

2. Quality assurance.

- 61. Monitor, inspect, and accept.**
- 62. Resolve delay issues.*
- 63. Issue a stop work order.*/**
- 64. Invoke commercial/simplified acquisition contractor performance remedies.***
- 65. Invoke noncommercial contractor performance remedies.***
- 66. Document past performance.

3. Payment and accounting.

- 67. Process contractor Invoices.
- 68. Assign claims. (Make payments)
- 69. Administer securities.*
- 70. Administer financing terms.*
- 71. Determine if reimbursement costs are allowable or unallowable.*
- 72. Make payment of approved indirect costs.*
- 73. Determine limitation of costs.*
- 74. Make price and fee adjustments.*
- 75. Collect contractor debts.*
- 76. Review contractors accounting and estimating system.***
- 77. Ensure Cost Accounting Standard (CAS) compliance.*

APPENDIX A. FEDERAL ACQUISITIONS PROCESS (Continued)

78. Guard against defective pricing.

4. Special terms.

- 79. Administer use of Government property.*
- 80. Manage intellectual property issues.*
- 81. Administer Socio-economic and other miscellaneous terms and conditions.*

5. Contract closeout or termination.

- 82. Resolve claims.*
- 83. Terminate contracts.***
- 84. Closeout contracts.
- 85. Guard against fraud.

Legend of relevance

- * When or as applicable.
- ** When prudent.
- *** When or as necessary.
- **** When needed/required.

APPENDIX B. SPS FUNCTIONS IN THE FAP

Phase I - Acquisition Planning		
FAP Function	SPS Performs?	Reference Notation
A. Determination of Need		
1. Forecasting Requirements	0	Util-SA-Reports-Cognos Impromptu & Powerplay
2. Acquisition Planning	0	Proc-Milestone & Workload reports
3. Purchase Requests	+	Proc-Rqmnt-PR Form
4. Funding	0	SA-Funds & Proc-PA/A-Certify Funds
5. Market Research	0	Proc-PA/A-Solic-SML (Vendor data base)
B. Analysis of Requirement		
6. Requirements Documents	+	Proc-Attachment & Rqmnt-MIPR & CDRL
7. Use of Government Property/Supply Sources	+	Proc-PA/A-Auto Order
8. Services	N/A	Not applicable
C. Extent of Competition		
9. Sources	+	Proc-PA/A-Solic-SML & Proc-CBD
10. Competition Requirements Unsolicited Proposals	0	Proc-PA/A-Solic (manually)
11. Set-Asides	+	Utilities-Set Asides & Buy USA
12. 8(a) Procurements	+	Utilities-Set Asides
D. Source Selection Planning		
13. Lease vs. Purchase		
14. Price Related Factors	-	
15. Non-Price Factors	-	
16. Method of Procurement or Purchasing	-	
	0	Proc-PA/A-Award (Suggests contract type)
E. Solicitation Terms & Conditions		
17. Contract Types— Pricing Arrangements	+	Proc-PA/A-Award (builds contract)
18. Recurring Requirements	0	Proc-PA/A-Auto Order
19. Unpriced Contracts	-	
20. Contract Financing	0	Progress payments
21. Need for Bonds	0	Delivery payment
22. Method of Payment	0	Proc-PA/A-Certify funds & prompt payment
23. Procurement Planning	+	Proc-User Workload & Workload Mgmt reports

(+) = SPS automates and performs

(0) = SPS only supports

(-) = SPS does not automate and support

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APPENDIX B. SPS FUNCTIONS IN THE FAP (Continued)

Phase II: Contract formation		
FAP Function	SPS	Reference
F. Solicitation of Offers		
24. Publicizing Proposed Contract Actions	+	Proc-CBD & EDI
25. Oral Solicitation	-	
26. Solicitation Preparation	+	Proc-PA/A-Solic
27. Pre-Award Inquiries	+	Proc-PA/A-Solic- PA Survey
28. Prebid/Prequote/ Preproposal Conferences	-	
29. Amending/ Canceling Solicitations	+	Proc-PA/A-Solic-Amendments and cancel
G. Bid Evaluation		
30. Processing Bids	N/A	Not applicable
31. Bid Acceptance Periods	N/A	Not applicable
32. Late Offers	N/A	Not applicable
33. Price Analysis —Sealed Bidding	N/A	Not applicable
34. Responsiveness	N/A	Not applicable
H. Proposal Evaluation		
35. Processing Proposals	+	Proc-PA/A-Offer Evaluation
36. Applying Non-Price Factors	0	Version 5.0
37. Price Analysis-Negotiations	0	Offer Evaluation (Price Analysis)
38. Pricing Information From Offerors	+	Proc-PA/A-Offer Evaluation
39. Audits	+	Proc-PostAward/Award-Audit tracking
40. Cost Analysis	-	
41. Evaluating Other Offered Terms/Conditions	0	Proc-PA/A-Offer Evaluation
42. Award Without Discussions	+	Proc-PA/A-Auto order
43. Communications/Fact-finding	+	Utilities-Documents Import-Tech. Evaluation
44. Extent of Discussions (Competitive Range)	0	Business Clearance Memo/Source selection plan and other documents as contract file attachments
45. Negotiation Strategy	0	Business Clearance Memo/Source selection plan and other documents as contract file attachments
46. Conducting Discussions/Negotiations	-	

APPENDIX B. SPS FUNCTIONS IN THE FAP (Continued)

Phase III. Contract Administration		
FAP Function	SPS	Reference
I. Contract Award		
47. Debriefing	-	
48. Responsibility	+	Proc-PA/A-Offer Evaluation
49. Subcontracting Requirements	0	Proc-PA/A-Offer Evaluation
50. Prepare Awards	+	Proc-PA/A-Offer Evaluation-Award
51. Issue Awards & Notices	+	Proc-Award-Release & EDI Transmit
52. Mistakes In Offers	0	Offer Evaluation (Pricing errors identified)
53. Protests	+	Proc-PostAward-Vendor Dispute Tracking
J. Initiation of Work and Modification		
54. Contract Administration Planning	+	Proc-PostAward-CDCS & Status tracking
55. Post-Award Orientations	-	
56. Consent to Sub-contracts	-	
57. Subcontracting Requirements	0	Utilities Auto tracking CLINS
58. Contract Modifications	+	Proc-PostAward-Modification
59. Options	+	Proc-PostAward Options
60. Task & Delivery Order Contracting	+	Proc-PostAward-Award & Utilites-Issue Tracker (IDIQ functions)
K. Quality Assurance		
61. Monitoring, Inspection, and Acceptance	+	Proc-PostAward-Award Status & Vendor Performance & Delivery & Discrepancy reports
62. Delays	0	Proc-Milestone
63. Stop Work	0	Proc-PostAward-Termination (and partial)
64. Commercial/Simplified Acquisition Remedies	0	Utilities-Auto Tracking (file attachments)
65. Noncommercial Remedies	N/A	Not applicable
66. Documenting Past Performance	+	Proc-PostAward -Vendor Performance and Version 5.0

APPENDIX B. SPS FUNCTIONS IN THE FAP (Continued)

Phase III Contract Administration (cont.)		
FAP Function	SPS	Reference
L. Payment & Accounting		
67. Invoices	+	Utilities-history files & Issue Tracker
68. Assignment of Claims	+	Utilities-Claims tracking
69. Administering Securities	N/A	Not applicable
70. Administering Financing Terms	N/A	Not applicable
71. Unallowable Costs	-	
72. Payment of Indirect Costs	0	Utilities-SA-Funds
73. Limitation of Costs	+	Utilities-SA-Funds
74. Price and Fee Adjustments	0	Proc-PostAward-Payment and Payment Requests
75. Collecting Contractor Debts	+	Utilities-SA-Funds
76. Accounting & Estimating Systems	0	Utilities-SA-Funds
77. Cost Accounting Standards	N/A	Not applicable
78. Defective Pricing	0	Organization Management (tracking violations)
M. Special Terms		
79. Property Administration	0	Version 5.0 (GFE tracking)
80. Intellectual Property	-	
81. Administering Socio-Economic/Misc. Terms	-	
N. Contract Closeout or Termination		
82. Claims	+	Proc-PostAward-Vendor Dispute Tracking
83. Termination	+	Proc-PostAward-Termination
84. Closeout	+	Proc-PostAward-Closeout
85. Fraud & Exclusion	0	Utilities-Auto tracking of protests and vendors can be excluded from source data base & ability to tie CLINS to Cure Notices, audits and disputes

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APPENDIX C. SPS FUNCTIONALITY BY VERSION

VERSIO	RQMTS/SOL	EVAL/AWARD/AD	PAY/CLOSEO
3.5	<ul style="list-style-type: none"> PR & Mods Forms (CDRLS, DD254, etc...) Preaward documentation Milestone planning Sol. Mailing lists CBD 	<ul style="list-style-type: none"> Price analysis SF 1409 abstracts Late offers DD1155 & SF1449 Track deliveries Concurrent mods Tracking: audit, dispute, performance Terminations 	<ul style="list-style-type: none"> Obligation tracking Payment tracking Closeouts
4.0		<ul style="list-style-type: none"> Construct A & E Foreign Currency 	
4.1	<ul style="list-style-type: none"> Updated forms (DD1155, DD1423, DD1707, SF18, SF1406) 	<ul style="list-style-type: none"> Process-based data flow Step ladder pricing Unpriced purchase order Termination for cause Automated clause logic DD350/1057 data validation EC/EDI EDA 	

APPENDIX C. SPS FUNCTIONALITY BY VERSION (Cont.)

VERSION	RQMTS/SOLIC	EVAL/AWARD/ADMIN	PAY/CLOSEOUT
4.2	<ul style="list-style-type: none"> Solicitations without funds or CLINs Free form text linked to CLINs or clauses Ability to define multiple PIIN serial counters EDI – 511c 	<ul style="list-style-type: none"> BOAs and Agreements Foreign Addressing Telecommunications Service Agreements Interface to financial systems Segmented long line of accounting Multiple instances of delivery and shipping information per CLIN 	<ul style="list-style-type: none"> EDI – Notice of final payment(567 transaction set) EDI – Contract Completion Statement(567 transaction set)
5.0	<ul style="list-style-type: none"> CLIN copy feature EDI – 511R 	<ul style="list-style-type: none"> Out of tolerance alerts CCR Interface EDI – 824, 855, 856, 865 Grants/Cooperative agreements All contract types permit award fee CLIN Enterprise data sharing (ACO/PCO) Expanded award paths Track packaging requirements Apply contract changes 	<ul style="list-style-type: none"> Archiving
5.1	<ul style="list-style-type: none"> Updated forms (DD254, DD1423, DD1707) 	<ul style="list-style-type: none"> Vendor Performance data Data driven DD1547 and DD1861 Offer Eval Automated Best Value CBDnet Automated workload assignment by codes Expanded currency conversion EDI – 843 mapped to vendor file 	<ul style="list-style-type: none"> Payment location identifier

LIST OF REFERENCES

1. Trimble, Stephen, *Pentagon Pushes To Restore Funding For Automated Procurement Program*, Defense News, Aug 23, 1999.
2. Anonymous, *What is SPS?* <http://dlasps.ctc.com/aboutsps.htm>. Aug 1999.
3. Davenport, Thomas H., *Process Innovation*, Harvard Business School Press, Boston, Massachusetts, 1993.
4. McCarthy, Theresa F., *Innovating the Standard Procurement Process*, Naval Postgraduate School Student Thesis, Dec 1998.
5. Hearn, Emmet, E., *Federal Acquisition and Contract Management*, Hearn Associates, 1996.
6. Federal Acquisition Institute, *The Federal Acquisition Process*, Mar 1999.
7. Federal Acquisition Institute, *Contract Specialist Workbook*, <http://www.gsa.gov/staff/v/fai/workbooks/directions2.htm>, Aug 1999.
8. Anonymous, *BotSpot: The Place for all Bots on The Net*, <http://www.botspot.com/> 1999.
9. Schutter III, George, A., *Process Innovation Through Alpha Contracting: An Analysis of Department of Defense Service Contracts*, Naval Postgraduate School Thesis, Dec 1998.
10. Minahan, Tim A., *The Network Effect: Extending the Benefits of Internet Procurement*, An Executive White Paper, Aberdeen Group Inc., Sep 1999.
11. Nelson, Mathew, *Ariba ORM Alleviates Heavy Operating Costs*, InfoWorld, Volume 19 Issue 30, Jul 28, 1999.
12. Major General Malishenko, Timothy P., *Standardizing the Procurement Process Worldwide Across the DOD - How a COTS Software Solution Is Changing the Way the DOD Buys*

Paperclips, Uniforms, and Weapon Systems, Contract Management, Volume 39, Issue 10, Oct 1999.

13. Verton, Daniel, *House Calls on DoD to Halt SPS Rollout*, Federal Computer Week, Aug 02, 1999.
14. Verton, Daniel, *DoD Says SPS Costs Rise \$100 Million*, Federal Computer Week, Aug 16, 1999.
15. Thurston, Gary, *November Standard Procurement System Presentation*, DCMC, Nov 1999.
16. Anonymous, *SPS Technical Architecture*, www.pd2.amsinc.com, Aug 1999.
17. Anonymous, *Acquiline - Acquisition on the Internet*, ARTwork, Issue 1, May 1999.
18. Fowler, David, *Innovating the Standard Procurement System with Intelligent Agent Technology*, Naval Postgraduate School Student Thesis, Dec 1999.
19. Major General Malishenko, Timothy, P. *PM Perspectives*, SPS Program News, Volume 1, Issue 2, Jul 1999.
20. Frook, John E., *SAP Slow to Simplify Purchasing*, InternetWeek, Issue 733, Sep 98.
21. Francisco, Bambi, *PurchasePro in Pact with VerticalNet*, Internet Daily, Nov 1999.
22. Hurwitz Group, *Choosing the Right Content Strategy for Business Commerce Networks*, Hurwitz Group Inc, Sep 1999.
23. Anonymous, *Ariba Inc. Corporate Facts*, Ariba Inc. Nov 1999.
24. Clark, Tim, *Ariba Software Helps Enterprise Buyers*, <http://news.cnet.com/news/0-1003-200-318885.html>, May 1997.
25. Nee, Eric, *Paper-clip software*, Forbes Sep 22, 1997.
26. Banzon, Jennifer, *Email Information Request Reply*, Ariba Education Consultant, Dec 1999.

27. Anonymous, *Ariba IBX*, www.ariba.com. Oct 1999.
28. Gumperz, Andrew, *Phone Interview*, Ariba Education Consultant, Nov 1999.
29. Guttman, R., Alexandros, G., Maes, P., *Agents As mediators in Electronic Commerce*, MIT Media Laboratory, Cambridge, MA, Oct 1999.
30. Anonymous, *Book 'Bot A Good Idea That Needs Work*, Netsurfer Digest, Volume 02, Issue 17 Jun 06, 1996.
31. Kerstetter, Jim, *Bots Add Value to Web Searches*, PC Week Online, Aug 16 1999.
32. Anonymous, *Comparison Shopping*, www.shop.lycos.com, Nov 1999.
33. InternetNews.com Staff, *Reverse Auction Launched for B-to-B E-Commerce*, E-Commerce Guide, Nov 19, 1999.
34. Nissen, Mark, *An Agent Federation for Supply Chain Integration*, Proceedings 1999 AAAI Conference, Orlando, FL, Jul 1999.
35. Maes, P., Guttman, R., Moukas, A., *Agents That Buy and Sell: Transforming Commerce As We Know It*. MIT Media Laboratory, Cambridge, MA, Mar 1999.
36. Nissen, Mark E, *Agents in Acquisitions*, MN2302 Seminar Briefing, Naval Postgraduate School, Winter Quarter 1999.
37. Weinriech, Christine, SPS Project Office, Headquarters Defense Logistics Agency, SPS Staff, Phone interview granted, 21 Nov 1999.
38. WWW Ethics Center, *Risk*, <http://onlineethics.org/text/glossary.html#RISK>, Dec 1999.
39. Anonymous, *Prototype*, DOD Dictionary of Military and Associated Terms, <http://www.dtic.mil/doctrine/jel/doddict/data/p/04986.html>, Dec 1999.

40. 106th Congress, *National Defense Authorization Act for FY 2000*, Oct 1999.
41. Anonymous, *AMS-Ariba Partnership to Provide First Comprehensive Government-to-Business eCommerce Solutions*, AMS Web-site, <http://www.amsinc.com/VendorRelations/Ariba.htm>, Dec 7, 1999.
42. Guttman, R., and Maes, P. *Agent-mediated Integrative Negotiation for Retail Electronic Commerce*, <http://commerce.media.mit.edu>, Nov 1998.
43. Björn, H. *"Intelligent Software Agents on the Internet"* <http://www.hermans.org/agents/h12.htm>. Nov 1998.
44. *Agent Mediated Electronic Commerce*, Home Page, <http://ecommerce.media.mit.edu/>. Nov 1998.
45. Hudson, J., *Software Agents and the Defense Information Infrastructure: Reengineering the Acquisition Process*, Naval Post Graduate School Student Thesis, Sept. 98.
46. Nissen, M., *Redesigning Software Procurement through Intelligent Agents*, <http://web.nps.navy.mil/~menissen/> Jul 1998.
47. Anonymous, *Agent Technology in Electronic Commerce and Information Retrieval on the Internet*, <http://www.scu.edu.au/sponsored/ausweb/ausweb96/tech/aoun/paper.html>. Dec 1998.
48. Jennings N. and Woolridge, M. *Applications of Intelligent Agents*, <http://www.springer.de/comp/special/agent.html>, Dec 1998.
49. Gilbert, D. *Intelligent Agents: The Right Information at the Right Time* <http://www.networking.ibm.com/iag/iaghome.html>, May 1997.
50. Kimbrough, S. *Bargaining Automation Project* <http://opim.wharton.upenn.edu/~sok/comprats/bapprecis.html>, Feb 1996.
51. Anonymous, *Market Maker*, <http://ecommerce.media.mit.edu/maker/maker2.htm>, Dec 1998.

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